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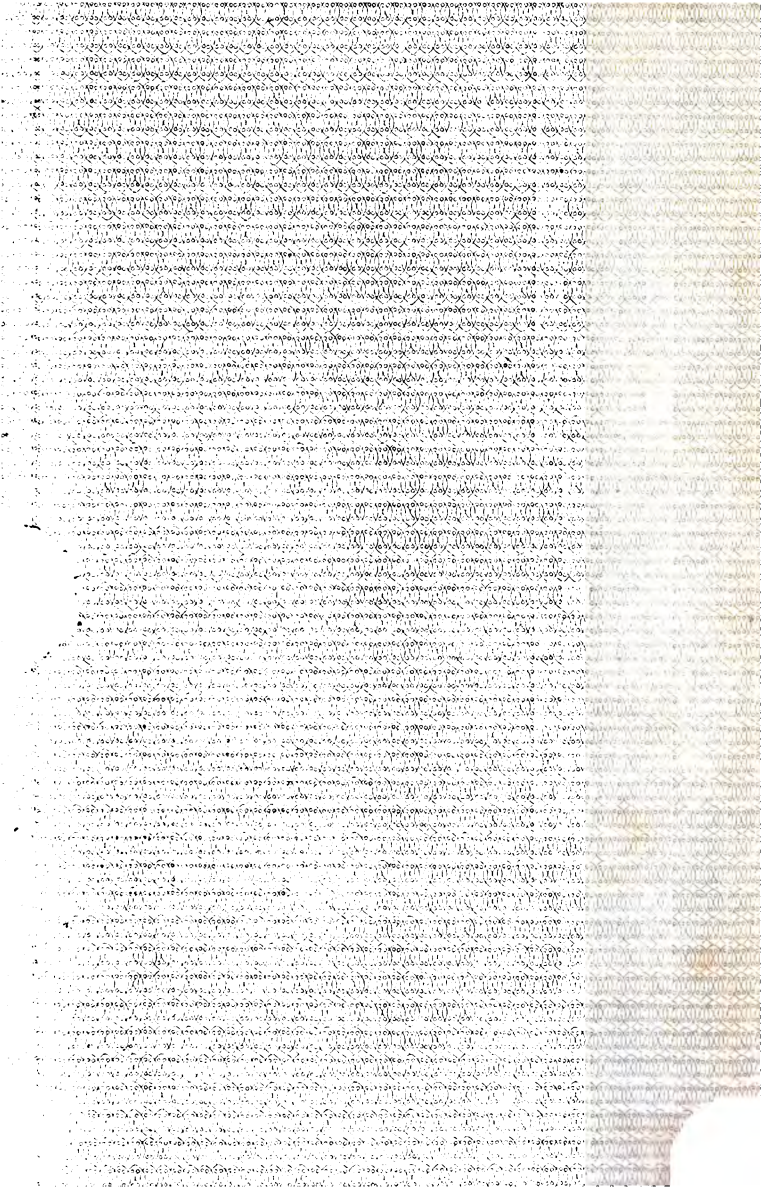

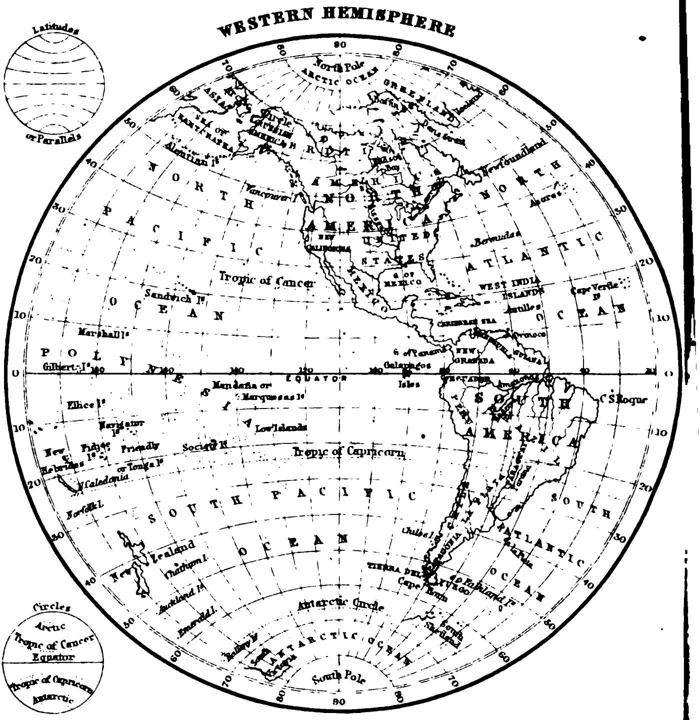

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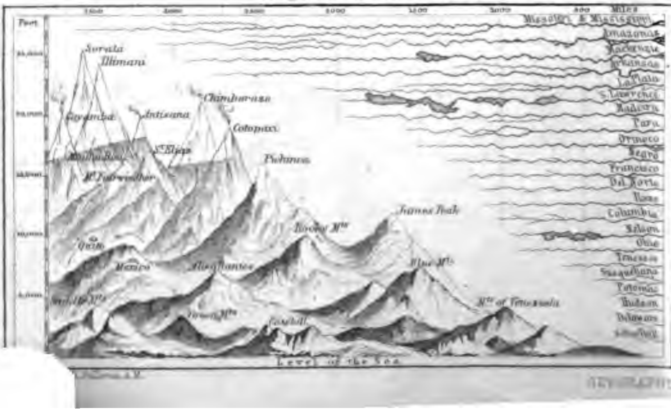

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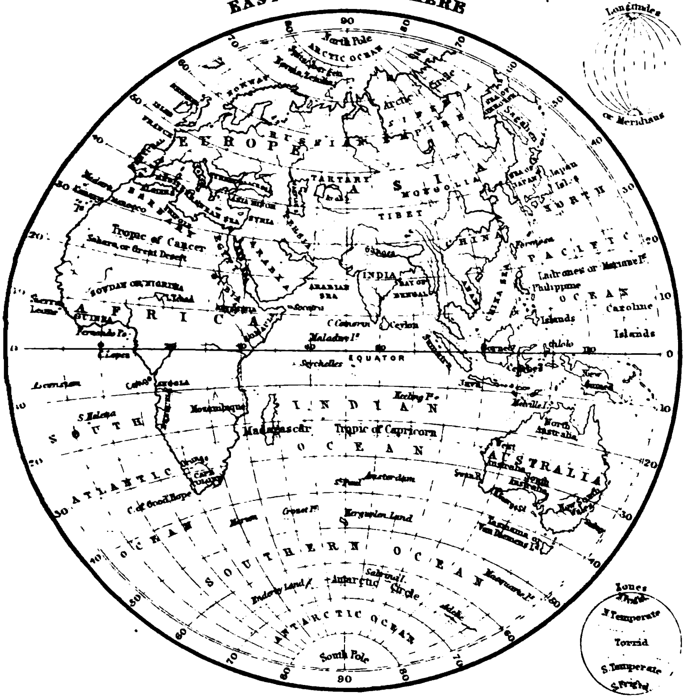

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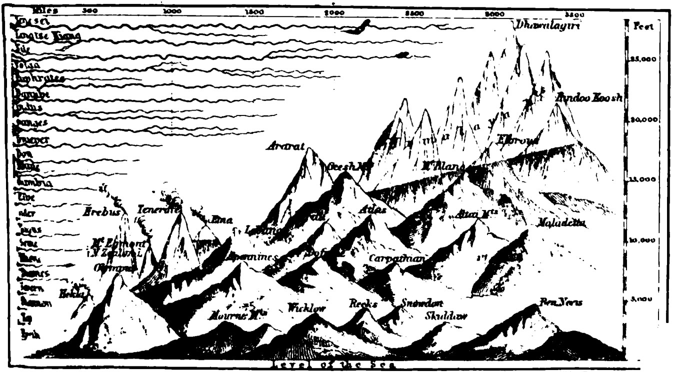

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ROBERT SULLIVAN, LL.D., T.C.D.

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PREFACE.

FIRST EDITION.

This little work is, as its title imports, an INTRODUCTION to the study of GEOGRAPHY. It will, however, be found to contain much more information upon this important and interesting branch of education than is usually met with in much larger volumes. This is entirely owing to the PLAN upon which it has been drawn up. Instead of dividing the attention, and oppressing the memory of the young student, by obliging him to learn and recollect the unconnected facts and innumerable details with which this, the most extensive of all the sciences, abounds, the essential facts and leading principles have been presented to his view under general and separate heads. In this way, he learns with ease, and recollects without effort, the general and fundamental principles of the science; and having thus fixed in his mind a clear and connected outline of the whole subject, he will be able to fill it up as he proceeds, not only without difficulty, but with pleasure.

As the PLAN of this work, and the advantages resulting from it, are fully developed in the ARTICLE headed "METHOD OF TEACHING GEOGRAPHY," page 119, the reader is respectfully requested to peruse it before he proceeds farther. To the Teacher of Geography this article is especially recommended. In fact, it is to him the most important part of the work.

It may appear strange that so large a portion of so small a treatise should be devoted to the *mathematical* part of Geography; but as the writer is convinced, that there can be no *rational*, and therefore no real knowledge of Geography, without clear and correct ideas of the FORM, MAGNITUDE, and MOTIONS of the earth, he determined to meet these difficulties in the outset, and to do every thing in his power not only to make them intelligible, but also easy and interesting to the youthful intellect.

Besides, the INTELLECTUAL method of teaching, now happily introduced into every good school in the country, requires the pupils to have a *rational* knowledge of every thing in which they are instructed. Formerly, the great majority of them knew little more of the sphericity of the earth, than that it was "round like a ball or an orange;" but now something more is required, both of the teacher and the pupils, than the twirling of a globe, the copying of maps, and the learning by rote from books the mere names of places.

The QUESTIONS FOR EXAMINATION will save the teacher much time and trouble. They will also materially assist the pupils in the preparation of their lessons, by enabling them to interrogate themselves and each other on the text before they go up to be examined by the master. The teacher will not, of course, confine himself to these questions; nor should he require his pupils to answer them in the words of the book. This would be to go back to the old and absurd method of teaching Geography by rote. A satisfactory answer in suitable language is all that the teacher should require; and if the pupil answers in his own language, so much the better.

A very useful exercise for the advanced classes will be, to assign a few of these questions to be *answered in writing.* In this case they should be allowed a few minutes to read over the page to which the questions refer; and *then having closed their books*, to give a suitable answer in writing to each question in order. With this view the questions have been paged and numbered. There can be no more useful exercise than this, as it enables the teacher to give lessons in Geography, Writing, Spelling, Grammar, and COMPOSITION, to large numbers of pupils at the same time.

EIGHTEENTH EDITION.

⁂ *An Introduction to Geology and some other useful Additions have been appended to the present Edition, instead of the "Examination Questions," which, from having been in so many preceding Editions, it is not considered necessary to repeat.*

EXTRACTS FROM CRITICAL NOTICES.

"So much information of so high a character, in so small a compass, and at so low a price, has rarely, if ever, appeared before."—"It exhibits the same originality of view, grounded upon the principles of the subject and the philosophy of teaching, which distinguish Mr. Sullivan's useful publications."—*Spectator.*

"It is particularly entitled to commendation, as more bad books have been written on Geography than on any other subject. Mr. Sullivan treats geography as a SCIENCE, which, like all sciences, must be taught on the principles of classification and comparison. The basis of his classification is what may be termed the Mathematics of Geography, and he therefore begins with explaining in clear and simple language the form, motions, and magnitude of the earth. As these cannot be comprehended without some knowledge of the physical sciences, he explains the nature of attraction, gravitation, &c., taking care to compare their laws with facts within the reach of ordinary observation. The divisions of the earth's surface are described in their physical aspect, and not according to the accidents of political distribution. The Exercises and Questions for Examination are excellent; they are constructed on the right principle of *compelling* the master to teach."—*Athenæum.*

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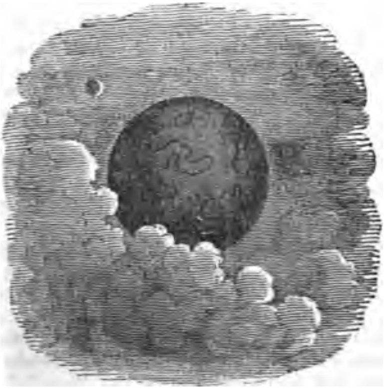
AN

INTRODUCTION TO GEOGRAPHY.

CHAPTER I.

FORM OF THE EARTH.



Geography, which, generally speaking, means a *description of the earth*, may be divided into three branches—Mathematical, Physical, and Political.

Mathematical Geography, which treats of the form, motions, and magnitude of the earth, is connected with the sciences of Mathematics and Astronomy.

Physical Geography treats of the great natural divisions of the earth's surface; its material and structure; its various productions, animal and vegetable; its atmosphere, climates, and other particulars respecting its *physical* or natural condition. This branch of Geography is connected with Natural History and Natural Philosophy.

POLITICAL Geography treats of the divisions of the earth into states and empires, with their extent, population, and resources; forms of government, laws, religions, customs, manners, learning, and other matters which pertain to man, as a political or social being. This branch of Geography is, consequently, connected with History and Political Economy.

The FORM of the earth is *globular*—that is, like a GLOBE or ball.[a]

An ORANGE will enable a teacher to give his pupils a familiar and tolerably correct idea of the form of the earth. After exhibiting an orange, let him ask them if it is a perfect globe or sphere, and they will soon discover that it is a little flattened at the *bottom* and *top*—that is, about the stem and the point opposite. And so, it may be observed, the curved surface of the earth is a little flattened at the *top* and *bottom*;[b] but not nearly so much in proportion to its size as an ORANGE.

Pass a knitting needle, or a piece of straight wire, through the centre of an orange, from the stem to the point opposite, and make it turn round upon it. This will exemplify the AXIS and DIURNAL motion of the earth.

The earth's surface, except where interrupted by elevations and declivities, *appears* to be flat, and not curved or globular; but this appearance is occasioned by the immense size of the earth. To a small insect, as a fly, creeping over an artificial globe its surface must appear flat, though we know that it is perfectly round or spherical; and so the surface of the earth appears to our bounded view. The tallest man, standing in the middle of the most extensive plain, cannot see the *surface*[a] of the earth farther than three miles round him. But a circle on the earth's surface six miles in diameter is far less in proportion than a circle the size of a sixpence on the surface of an artificial globe. But such a circle, or even a much larger one, if cut out of an artificial globe, would appear *flat*, though we know that its surface is perfectly *globular*. Nor do the mountains, nor the other inequalities observable on the earth's surface, destroy its sphericity. If we examine the surface of an orange, we shall find it full of little inequalities, the least of which is greater, in proportion to the size of the orange, than the highest mountain on the earth's surface is to the magnitude of the earth.[b] In fact, the smallest grain of sand on the surface of an artificial globe twelve inches in diameter, would be larger in proportion to such a globe, than the highest mountain on the surface of the earth would be to the great globe of the earth. But oranges appear round and smooth notwithstanding the inequalities on their surface; and so would the earth, if we could view it as an immense globe or ball.

---

[a] A GLOBE or SPHERE is a perfectly round body like a ball or marble. A SPHEROID differs from a perfect sphere by being either *flattened* about the top and bottom, like an ORANGE, or *elongated*, like a LEMON. The former is called an *oblate*, and the latter a *prolate* spheroid. The word spheroid means *like*, or nearly *a sphere*.—See page 38.

[b] That is, about the POLES. The earth differs so little from a perfect sphere, compared with its great magnitude, that in any representation which we could make of it, the difference would be too small for perception. Hence, even the largest artificial globes are made perfectly round.

That the earth is a globe or sphere has been often proved *practically*. Several navigators have actually sailed round the world—that is, they have, by continuing their course to the *westward*, returned to the place from which they set out by the *eastward*, and *vice versâ;* just as we may have seen a fly creeping down one side of an artificial globe and up the other.

MAGELLAN was the first person who *circumnavigated* the earth; but COLUMBUS first attempted it, and to him, consequently, the chief credit is due. Columbus, convinced in his own mind of the sphericity of the earth, concluded that he could reach the *East* Indies by continuing his course to the westward; and so he would, had not the world of which he was the discoverer intervened.

---

[a] The earth's surface curves or slopes about eight inches in a mile, and this curvature increases with the square of the distance. Thus, in two miles the curvature is 4 times 8, or 32 inches; in three miles, 9 times 8, or 72 inches; and so on, as the square of the distance. The eye of a man six feet high is not elevated 72 inches, or 6 feet above the surface, and therefore, in the position in which we have supposed him, he cannot see the *surface* three miles around him.

[b] To represent in *relief*, and in relative proportions, the highest mountain in the world on the surface of an artificial globe twelve inches in diameter, we would require a grain of sand the 130th part of an inch in thickness—in fact, an almost imperceptible atom. For five miles, the height of, perhaps, the highest mountain in the world, is only about a 1600th part of the earth's diameter; and the 1600th of the diameter of a 12-inch globe is only about the 130th part of an inch.

We shall now state briefly the arguments which led Columbus, and others long before his time, to conclude that the earth was a sphere or globe.

If the earth be a plain surface, extending out to the skies, as it *appears to be*, and as the uneducated still think it, the sun and the other heavenly bodies would, when they rise above the horizon, be visible all over the world at the same time. But we know that this is not the case. To persons living to the *eastward*, the sun appears sooner than to persons living to the *west;* and we know that when the sun disappears below our horizon, he rises to countries *west* of us. This is occasioned by the *curved* or *convex* form of the earth's surface; just as a mountain, interposed between us and the rising or setting sun, intercepts him from our view

It was this circumstance that first led the philosophers of antiquity to conclude that the earth was a *spherical* or round body. In proportion as they travelled *eastward* or *westward*, they observed that the sun rose sooner in the one case, and later in the other. They concluded, therefore, that the earth's surface, at least from *east* to *west*, must be *globular*. But they likewise observed that if they proceeded *northward* or *southward*, the POLAR STAR appeared to ascend or descend in proportion to the space passed over; and that while *new* stars appeared above, others, with whose appearance they had been long familiar, sank below the horizon. They, therefore, concluded that the surface of the earth from *north* to *south* also was *globular;* and as similar appearances were observed in every direction, they finally came to the conclusion that the earth was an immense SPHERE or globe.

Other and more familiar proofs of the earth's sphericity may be added. As a vessel recedes from the land, the spectators on shore lose sight first of the hull, next of the lower sails, and finally only the tops of the masts are perceptible. This is evidently not the effect of *distance;* for, if so, the masts, which are *smaller* than the hull or body of the ship, would first disappear. It is occasioned by the *convex* or globular surface of the sea, which rises up between the ship and the spectators. This they may easily prove; for if they immediately ascend a tower or eminence, the vessel will again be visible. Similar appearances present themselves to the persons on board the vessel; first the shore begins to sink, next the buildings, next the tops of spires and mountains only are perceptible, and finally they lose sight of land. It is under these circumstances that—

> "The sailor sighs as sinks his native shore,
> And *climbs the mast* to feast his eyes once more."

Similar appearances are observed in every part of the earth, and in every direction. Towers and mountains, as we recede from them, seem to sink below the horizon, their *bases* disappearing first, next their middle parts, and finally their summits. And in every sea in the world, and in every direction, the most extended view is had from the *mast-head* of the vessel; and hence sailors always go aloft when they are on the look-out for land, or for any other object which they may wish to seek or shun.

It may now be added, that the earth could be nothing else than a *sphere*, in accordance with its motions as a PLANET, of which we shall presently speak; and even the cause of its sphericity may be shown.

We know that every particle of matter attracts and is mutually attracted by every other particle of matter which comes within the sphere of its influence; and consequently, that the greater the quantity of matter, the greater will be the attractive power. Hence the several kinds of attraction, which are all modifications of the same principle:— 1. COHESION, or *the mutual attraction* of minute particles of matter[a] in contact with each other. 2. GRAVITATION, or that power which causes bodies to attract each other in proportion to the quantities of matter which they contain.[b] 3. MAGNETISM, or that property in the *magnet* or loadstone which *attracts* iron. 4. ELECTRICITY,[c] which is exemplified by the *attraction* of feathers, or light substances suspended near the electrical conductor.

---

[a] Of the same kind.

[b] And inversely as the square of the distance.

[c] Electricity, from *electron*, the Greek word for amber, in which this property was first observed. The term *electron* was applied to other *shining* substances, as to a mixture, four parts gold, and one part silver. The root is *helios*, the sun, as in peri*helion*.

It is the attraction of *cohesion* which causes the particles of matter of which bodies are composed to *cohere* or stick together. Without it, all the bodies in the universe would fall into pieces, or rather crumble into indivisible particles or ATOMS. It was this property, originally impressed upon matter by the hand of the Creator, which caused the earth, the planets, and all the heavenly bodies to assume, and still enables them to retain their *globular* forms. One of our poets has beautifully and truly said—

> That very law which moulds a tear,
>   And bids it trickle from its source—
> That law preserves the earth a sphere,
>   And guides the planets in their course;

for the same principle is exemplified in the dew-DROPS which hang from the thorn, and in the rain-DROPS which fall from the clouds. The minute vapoury particles of which DEW and RAIN are composed, by coming into contact, mutually attract each other, and form into DROPS or small globes.

The numerous globules into which a small quantity of quicksilver forms, when it falls upon a table or the floor, exemplify the same principle. The particles which come into contact attract, and are attracted by each other, mutually, on all sides, and hence the globular form is assumed.[a] And, as from the nature or form of a globe there is more matter in the direction of its centre than in any other, the general attraction of all the constituent particles or parts will be towards the centre.

Apply this to the original formation of the great globe which we inhabit. "In the beginning" it was "without form and void;" but when destined for the abode of man, its elements by the Creative Word were reduced to order; and from a *chaotic* and *homogeneous* state, it assumed, in consequence of the mutual and general attraction of all its constituent particles, the form of a GLOBE. And here it may be observed, that this was the only form which the earth could assume consistent with its position in pure space, and the *rotatory* motion which, for the benefit of mankind, it was destined to perform. For, suppose a round body like the earth were placed in pure space, remote from the attractive influence of any other body, it is easy to conceive that it would, self-balanced and self-supported, remain in the same position for ever. It would neither move *down*, nor up, nor backwards, nor forwards, nor in any direction whatever; for we have supposed that there are no other bodies to *attract* or draw it towards them. In fact, such a body, in such a position, would be without weight or gravity; for all its parts, on every side, would be attracted towards its centre or middle point,[a] and an EQUILIBRIUM would be produced.

---

[a] The same principle is exemplified in the manufacture of shot. "If the small shot which is used by sportsmen were cast in a mould, the price would be enormous; but by pouring the melted lead of which the shot is made, through a cullender placed at the top of a tower high enough for the lead to cool in its passage through the air before it reaches the ground, *the shot is formed in a spherical or round shape, by the mere act of passing through the atmosphere.*" — *Results of Machinery.*

The CENTRE OF GRAVITY of a body is that point on which the whole *weight* is, as it were, *concentrated* or balanced; and if the body be a globe of uniform density, it is evident from what has been said, that the centre of gravity will coincide with the centre or middle point of the globe. In this way, all the parts of the earth, on every side, are attracted towards its centre or middle point; and so is every thing, and every person on its surface; and there is not the least danger of us falling from it, though our feet are often up, and our heads down, like flies on the ceiling. But the fact is, our feet are always *down* and our heads *up;* for these terms properly refer to the *centre* and *surface* of the earth. The *middle* point of a globe is the *lowest*, and *down* consequently means in the direction of the *centre;* and *up*, from it towards the *surface;* and it is in this way we use these terms with regard to the *earth*. But with regard to the heavens, the direction expressed by these terms is constantly changing. What we call up, during the day, we call down, during the night. Our ANTIPODES, therefore—that is, the inhabitants of the earth who live on the opposite side of it, and consequently have their *feet opposite* to ours—are in no more danger of falling off than we are ourselves. They have, like all the inhabitants of the globe, the earth beneath their feet, and the heavens above their heads.

---

[a] On the supposition that the density of the entire body is uniform

CHAPTER II.

MOTIONS OF THE EARTH.

If you hold a small globe or ball before a candle, you will observe that the *one-half*[a] of it will be *illuminated* and the other half *shaded;* and if you make the ball spin or turn round, you will see that half of it will be in the light, and half in the shade, in succession.

Now this is an exact representation of the DIURNAL or daily motion of the earth. The earth is a *globe*, and as it turns round and round before the sun, the *one-half* of it is *enlightened* by his rays, and the other half deprived of his light, in succession. With the *half* turned *towards* the sun, it is *day*, and with the half turned from the sun, it is night. And as the earth is twenty-four hours[b] in turning once round before the sun, the length of the day and night taken together is twenty-four hours.

If you pass a piece of *straight* wire through the middle of an orange, from the *stem* to the *point opposite*, and make the orange turn round and round upon the wire, you will have a representation of the AXIS, POLES, and DIURNAL MOTION of the earth. For, as the orange may be made to turn on the wire like a wheel on its *axle*, so the earth turns round an imaginary straight line passing through its centre, from the north to the south points of its surface. This line is called the AXIS of the earth, and its extreme points or ends, the POLES:[c] the upper,[d] the NORTH pole, because it always points in the direction of the *north* pole of the heavens; and the lower, the SOUTH pole, for a similar reason.

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[a] This arises from the nature or form of a globe. When a cube, or any other solid figure, is presented to a luminous body, only one side is enlightened.

[b] Accurately, 23 hours, 56 minutes, and 4 seconds.

[c] *Pole*, from a Greek word signifying to *turn;* whence also *pulley*, on which the rope *turns*. Most children, and indeed teachers too, confound this term with *pole*, a long rod or staff. The idea of the *axis* naturally leads to this mistake.

[d] The *north* was called *upper*, because the early astronomers, like ourselves, dwelt nearer to the north pole of the earth, which they supposed to be uppermost.

In turning the orange round the wire, you will observe that every point on its surface moves round and round, except the points in which the wire terminates; and hence these points are called *poles*, because the earth *turns* round and round them, while they continue at rest. A top in motion, or a ball made to spin upon a table, may be given as additional illustrations of the earth's motion round its axis and poles.

The *rotation* of the earth on its axis in twenty-four hours from *west* to *east*, gives the sun and all the heavenly bodies the *appearance* of revolving in the contrary direction, that is, from *east* to *west*, in the same time; just as you may have observed, while travelling in a carriage or sailing in a boat, that the trees, houses, and other fixed objects, *appeared* to move past you in the opposite direction, while you fancied yourself to be at rest. If the motion of the carriage or boat in which you are supposed to be placed were perfectly *smooth* and *steady*, the more strongly would these appearances present themselves, and the less conscious would you be of your own motion. To persons ascending in balloons, it is said, that the earth *appears* to sink beneath the balloon, instead of the balloon appearing to rise above the earth.

In this way, while the earth turns round its axis with a *perfectly* smooth and uniform motion, the sun, and all the heavenly bodies, *appear* to us to move in the opposite direction, while the earth appears to be fixed and immovable.

The same *phenomena* or appearances would be produced if, as was formerly believed, and as the uneducated still think, the sun and all the heavenly bodies revolve round the earth from east to west in twenty-four hours, while the earth itself continues at rest in the centre; but such a supposition is inconsistent with that sublime simplicity which characterizes all the works of the Great Author of Nature. The vicissitudes of DAY and NIGHT, so essential to the enjoyment and relaxation of man, are produced by one of two causes: either the earth turns upon its axis in twenty-four hours, presenting every part of its surface in succession to the sun, or the sun revolves round the earth in the same period of time. No third opinion can be formed on the subject. If the second supposition is correct, then must the sun every twenty-four hours describe a circle of nearly

600[a] millions of miles in circumference! For the distance of the sun from the earth would be the semi-diameter of the circle which the sun, on the supposition of his revolving round the earth, would have to describe every day—and this distance is known to be 95[b] millions of miles. But this motion, inconceivable as it is, would be nothing compared to the velocity with which the FIXED STARS would have to revolve; for if the earth does not turn on its axis, then not only the sun, but the ENTIRE UNIVERSE must move round it in twenty-four hours! Now words cannot express, nor imagination conceive, the number of the fixed stars. To Dr. Herschel, looking through his celebrated telescope in the direction of the milky way, they appeared, to use his own language, "scattered in millions like glittering dust;" and their distances from our globe are equally astounding. *Light* which travels from the sun to the earth in eight minutes—that is, *ninety-five millions of miles in eight minutes*—would, it has been computed, be more than three years in coming to us from the *nearest* fixed star!

Are we to conclude, then, that the sun, and millions upon millions of stars, scattered at all possible distances in the heavens, above, beneath, and around us, revolve round the earth in twenty-four hours, as they *appear* to do; or that the same effect is produced by a simple rotation of the earth on its axis in the same time? The result, as we have observed before, would, in either case, be the same: but in the one, the means employed would be simple and natural: in the other, complicated, and, to our conceptions, impossible. We have said nothing of the surpassing magnitudes of the sun and stars[c] compared to that of the earth, and the consequent absurdity of supposing that *innumerable* large bodies revolve round our globe, which is a mere point when compared to any one of them.

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[a] The circumference of a circle is something more than three times the diameter, and, of course, more than six times the semi-diameter.

[b] The sun is more than a million of times larger than the earth, and there is every reason to suppose that each of the fixed stars is a sun!

[c] Of the magnitude of the fixed stars nothing is known, except by inference that they are *the suns* of other systems. Such is their amazing distance, that even when viewed through the most powerful telescopes, they appear, as they do to the naked eye, mere luminous points, their brilliancy only being increased.

ANNUAL MOTION.

DAY and NIGHT, as we have seen, are produced by the rotation of the earth on its axis from west to east every twenty-four hours. We have now to explain the vicissitudes of the SEASONS. Besides the motion of the earth upon its axis every twenty-four hours, it moves round the sun in the course of a year, in a path nearly circular. The circumference of the circle which the earth describes in moving round the sun is called the earth's ORBIT, and the *plain* level surface included within, or circumscribed by the orbit, is called the PLANE of the earth's orbit. The word *orbit* means a *circular* track or path; and the term *plane*, a level or *plain* surface. The *circular* edge of a round table may represent the *orbit* of the earth, and the *surface* of the table its *plane*. Not that we are to suppose that the orbit of the earth is a solid or substantial ring, nor its plane a real, visible, flat surface; for the earth and all the planets perform their revolutions round the sun, with unerring regularity, in pure and pathless space.

To illustrate what has been said, carry a small globe or ball round a candle in a *circular* direction, and make it turn, at the same time, round and round, as if upon an axis. These motions given to the ball represent the *diurnal* and *annual* motions of the earth. The *circumference* of the circle described by the *centre* of the ball in moving round the candle, represents the earth's *orbit*, and the space which the orbit circumscribes or includes, its *plane*. The *plane*, as the term denotes, is in a *level* or line with the orbit that is, neither rising above nor sinking below it.

The *axis* and *poles* of the earth we have already described; we have now to add the EQUATOR.

The poles are the extreme *northern* and *southern* points of the earth's surface; and if you make the ball spin round, you will observe that the part of it which has the greatest motion is exactly *midway* between, or *equally* distant from the poles. Round this part draw a line or circle, and you will have a representation of the *equator*,[a] which is so called, because it is *equally* distant from each pole. The equator runs east and west, and divides the globe into the NORTHERN and SOUTHERN HEMISPHERES, or *half globes*.

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[a] It is also called the EQUINOCTIAL LINE and sometimes, by way of eminence, THE LINE.

Let the small globe or ball, with the poles and the equator marked upon it, be carried round the candle in an erect position, that is, with its axis perpendicular to the plane of its orbit, and it will be evident that the candle will shine *directly* on the middle or equatorial parts of the ball, and *obliquely* on the parts in the direction of, and about the poles.

Now, if the earth moved round the sun in this way, that is, with its axis perpendicular to the plane of its orbit, it is easy to conceive that the sun would shine *directly* on the middle or equatorial part of it, and *obliquely* on those parts in the direction of, and about the poles. But if this were the case, there would be no *seasons*, and consequently, neither animal nor vegetable life in the world. The middle or equatorial parts of the earth would be parched and burned up by their constant exposure to the direct rays of the sun; perpetual spring would reign in those parts of the world which enjoy the pleasing vicissitudes of the seasons;[a] and in the polar regions, the rigours of winter would continue unbroken throughout the year.

But the earth does not, as *we* would think it should, move round the sun in an upright position, but in a *slanting* direction. The axis, instead of being *perpendicular* to the plane of its orbit, *inclines* or leans to it at an angle of 66½ degrees; and as it always points to the same part of the heavens, the northern half of the axis, and consequently the *northern hemisphere*, will, during one period of the year, *incline to*, and at another *decline from*, the sun. When the *northern* half of the axis of the earth is *inclined* to, the *southern* will, of course, be *declined from* the sun; and hence, when it is SUMMER in the northern, it will be WINTER in the southern hemisphere, and *vice versâ*. During two periods of the year the axis of the earth neither inclines to, nor declines from the sun, and the consequence is, that it is neither summer nor winter in the northern and southern hemispheres. At these periods both hemispheres enjoy an equal degree of light and heat from the sun, and they are called the EQUINOXES — because the *night* and, of course, day are *equal* all over the world.

To illustrate what has been said — for descriptions, and even diagrams, fail to produce clearness in the minds of children in such matters — let the instructor carry a *straight* rod or ruler round the edge of a circular table, and let one half of the ruler be above, and the other below the edge of the table. If the ruler is carried round in an *erect* position, it will be evident to the pupils that it is *perpendicular* to the surface or *plane* of the table, and also that it moves *parallel to itself*, or to the direction in which it was when it commenced to be carried round. In this position the ruler will make an angle of ninety degrees with the plane of the table — for ninety degrees, or the *fourth* part of a circle, is the measure of every *right* angle. But if the ruler be inclined towards the table at an angle of 66½ degrees, and made to preserve its parallelism as it is moved round, it will represent the angle made by the axis of the earth with the plane of its orbit, and its inclination towards the sun throughout the year.

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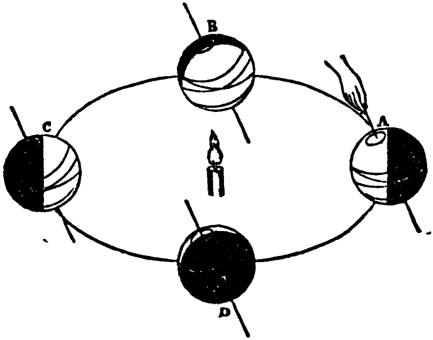
[a] The north and south Temperate Zones.—See page 49.

As a farther illustration, let the small globe, upon which we marked the poles and equator, be carried round a candle supposed to represent the sun, ***in the same way as the ruler has been moved round the table***, and the causes of the SEASONS will be evident.

In the following diagram, the position of the earth with regard to the sun at midsummer, midwinter, and the equinoxes, is represented.



At A. the northern half of the axis is inclined to the sun, and the northern hemisphere, in consequence, enjoys much

more of his rays than the southern. In this position of the earth, the sun shines *perpendicularly* over the TROPIC OF CANCER, and consequently 23½ degrees over and beyond the *north* pole; for as the earth is a *globe*, the sun shines over the one *half* of it, or in other words, over ninety degrees in every direction, from the point over which his rays are perpendicular. In this case, the entire of the *north* FRIGID ZONE will be within the *illuminated* hemisphere, and it will be constant day there while the earth remains in this position with regard to the sun. It is obvious, too, that in this case the rays of the sun will fall short of the south pole by 23½ degrees, and that, consequently, the entire *south* FRIGID ZONE will be deprived of his light while the earth continues in this position with regard to the sun.

Suppose the earth to have moved to B, and observe that its axis is neither inclined to nor declined from the sun. In this case, the sun is perpendicular to the equator, and, consequently, shines ninety degrees above and below it, or, in other words, from pole to pole. In this case too it is obvious, that the days and nights are equal all over the world; for not only the equator, but all the parallels of latitude are bisected or cut into two equal parts by the CIRCLE OF ILLUMINATION. By the *circle of illumination* is meant, the circle which divides the hemisphere presented to the sun, from the hemisphere which is deprived of his light. And as this circle divides the globe into two equal parts, it is a *great* circle; and as all great circles bisect each other, it, in every situation of the earth, divides the equator into two equal parts. It is this circumstance which causes the days and nights to be of equal length at the equator throughout the year. *One half* of it is within the *enlightened*, and the *other half* within the *darkened* hemisphere: and as the *entire* circle turns round in twenty-four hours, it is evident, that *each half* of it will turn round in twelve; or in other words, the days and nights will be of equal length.

The same explanation applies to all the circles parallel to the equator, or, as they are usually called, parallels of latitude. When the earth is in the position now described, they are all *bisected*, or divided into two equal parts by the circle of illumination; and the days and nights are consequently equal all over the world. But when the sun is *above* or *below* the equator, that is, north or south of it, all the parallels of latitude are *unequally* divided by the circle of illumination, and the days and nights are consequently of unequal length. When the sun is *north* of the equator, *more* than half of each of the parallels of latitude in the *northern* hemisphere is within the circle of illumination, and the days are consequently *longer* than the nights; and when the sun is *south* of the equator, the contrary is evidently the case.

In explaining to the pupils what is meant by the circle of illumination, the teacher should not trust entirely to the diagram. He will give them a clearer conception of it by holding a small globe before a candle in different positions, and by calling upon them, at every change, to point out its *boundary* and the *direction of its plane*, which, as it is a *great* circle, always passes through the centre of the earth. If the north pole or axis of a small globe, for example, is held opposite the candle in a straight line with the centre of the light, it will be evident that the entire northern hemisphere would be *within*, and the southern *without* the circle of illumination; and that if the earth turned round in this way before the sun, it would be perpetual day in the one hemisphere, and perpetual night in the other. In this case it will be evident, that the boundary between the enlightened and shaded hemispheres, or in other words, the *circle of illumination*, will exactly coincide with the equator, and consequently that its plane will pass through the centre of the globe perpendicular, or at right angles to its axis. In this case, it is obvious that the plane of the circle of illumination would be perpendicular to a line drawn from the centre of the sun to the centre of the earth,[a] to which we suppose the sun's rays to be parallel; for in this position the *axis* represents that line; and it may be easily shown that it is always so, in every situation of the earth with regard to the sun.

If the pupils get a clear idea of what is meant by the circle of illumination, keeping in mind that the earth, in moving round the sun, has its axis inclined to its orbit at an angle of 66½ degrees, and that it always points to the same part of the heavens,[a] they will feel no difficulty in comprehending the causes of the seasons, or in determining the length and general temperature of the days, in every part of the earth, throughout the year.

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[a] For in this case, the plane of the circle of illumination coincides with the plane of the equator, which is evidently at right angles to the axis of the earth.

Let us take another view of our diagram, page 19. Here we have represented the position of the earth with regard to the sun on the 21st of June, the 22nd of September, the 21st of December, and the 20th of March—that is, during the summer and winter *solstices*, and the vernal and autumnal *equinoxes;* and in each position of the earth it is evident that its axis points in the same direction, moving, as is said, parallel to itself.

At A, or during the summer solstice, the sun is perpendicular to the TROPIC OF CANCER, or to that part of the earth's surface which is 23½ degrees *north* of the equator; and as he always shines over ninety degrees in every direction, from the point over which he is perpendicular, it is evident that his light will be diffused 23½ degrees over and beyond the *north* pole, while the same extent of surface round the *south* pole will be deprived of his rays. And hence, as in the diagram, the entire *Arctic* circle comes within, while the *Antarctic* lies without the circle of illumination; *and it is for this reason* that these circles are described 23½ degrees distant from each pole.

The earth proceeds in her course, and in three months after is in the position represented at B. Here the sun, which, in consequence of the *earth's motion* in her orbit, has been daily withdrawing his rays from about the north pole, is perpendicular to the equator—and the circle of illumination, consequently, extends from pole to pole.

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[a] If a person move round the edge of a circular table in the middle of a room, his head will appear to describe a corresponding and equal circle on the ceiling—and yet the axis of the earth, though it describes, in the course of a year, a circle of 190,000,000 of miles in diameter, always points to the same spot in the heavens—that is, the pole or extremity of the earth's axis always points to the pole of the heavens or polar star! This arises from the amazing distance of the fixed stars, which causes, not only the earth, but the entire orbit in which it moves, to appear as a mere point in comparison. This may be illustrated by drawing upon an elevation three or four *parallel lines*, ten or fifteen feet from each other. If we look along them, they will *all* seem to point *directly* to the moon in the horizon, which, of course, is occasioned by the great distance of the moon from us; and, perhaps, the distance between the lines (10 or 15 feet) will bear as great a proportion to the distance of the moon (240,000 miles), as 190,000,000 of miles to the distance of the polar star!

At C in the diagram the winter solstice is represented. In this case the rays of the sun are perpendicular to the TROPIC OF CAPRICORN, and the circle of illumination consequently sweeps round the *south* pole, and 23½ degrees beyond it, leaving the north pole and 23½ degrees around it (that is, the entire north frigid zone) involved in darkness.

At D the earth has arrived at the vernal equinox, and the sun is again perpendicular to the equator, and the circle of illumination again extends from pole to pole.

But how do we know that the earth moves round the sun? Besides the sun's apparent diurnal motion from east to west, he appears, when closely observed,[a] to move nearly a degree, or about twice his own diameter, every day to the eastward, and thus, in the course of a year, to complete a great circle in the heavens. But his apparent diurnal motion has led us to doubt the evidence of our senses in these matters, and a little reflection will convince us that his annual motion also is merely apparent, and that the circle which he seems to describe in the heavens is really described by the earth in travelling round her orbit. In illustration of this, place a globe or candle on a table in the middle of a room, and move round it in a circle, keeping your eye upon it and the wall in a line with it. In this case the globe or candle, though fixed in the middle of the room, will appear to you to describe a circle round the wall. And thus the sun, though at rest in the centre, appears to us to describe a circle round the heavens, which is really described by the earth in its orbit; the earth describing one part of the circle while the sun appears[a] to describe the opposite.

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[a] If, by means of a telescope, or through the shaft of a very deep mine, the sun be observed in a line with a fixed star, the next day, at the same hour, he will appear to have moved nearly a degree, or about twice his own diameter to the *east* of such star; and in twenty-four hours more, another degree eastward, and so on, till having completed a great circle in the heavens, he returns, in the course of a year, to the same fixed star. Observations to the same effect may be made on any clear evening after sunset. If a star be observed near the horizon to the eastward of the place where the sun appeared to set, the next evening, at the same time, it will appear nearer to the place where the sun disappeared, and next still nearer, and so on till it sets along with the sun, and is consequently lost in his rays.

The circle which the sun thus appears to describe in the heavens among the fixed stars, is called the ECLIPTIC;[b] because as it is in the same plane with the earth's orbit, an *eclipse*[c] will take place when the moon comes within it.

As an illustration of this, let the circle which your head, in moving round the globe just referred to, may be supposed to have described, represent the *orbit* of the earth, and the circle apparently described by the globe round the walls of the room represent the *ecliptic*, and it will be evident that these circles have the same centre and lie in the same plane. Now hold up an orange or a ball in a line between your eye and the centre of the globe and you will have a representation of an *eclipse*. The *globe* is supposed to represent the sun, your *head* the earth, and the *orange* the moon; and, as they all lie in the same plane, it is evident that the orange will intercept a portion of the globe from your view. This is a representation[d] of an eclipse of the *sun*; and if you turn your back to the globe, keeping the orange in the same line with it and your head, you will have a representation of an eclipse of the *moon*—for in these cases, your head will *intercept* the light supposed to come from the globe to the orange. If you *raise* or *lower* your hand no eclipse will take place; because, in these cases the orange would be either *above* or *below* the plane of the ecliptic. And it is in this way that the moon generally moves either a little above or a little below the plane of the earth's orbit, otherwise there would be two eclipses every month—one of the *sun* at new moon, and another of the *moon* at full moon.

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[a] Thus, when the earth is in Libra, the sun appears to be in the opposite sign, Aries; and when the earth moves to Scorpio the sun seems to enter Taurus, and so on.

[b] *Ecliptic.*—As this circle was supposed to be described by the sun in 360 days, the ancient astronomers divided it into *three hundred and sixty* equal parts, which they called DEGREES, to denote the (*steps*) progress made each day by the sun; and hence the division of the circumference of ALL CIRCLES, *great* and *small*, into *three hundred and sixty* equal parts or DEGREES. The ecliptic is also divided into twelve equal parts, containing thirty degrees each, to correspond to the *twelve* months of the year. These parts are called the SIGNS of the ZODIAC, because they are generally represented by the *signs* or figures of *animals*. The term ZODIAC, which is derived from a Greek word signifying *animal*, is applied to a broad circle or belt in the heavens, extending about eight degrees on each side of the ecliptic. In this circle the earth and all the planets revolve; so that no planet (except some of the *Asteroids*) is ever seen more than eight degrees north or south of the ecliptic—that is, above or below it. The names of the twelve signs are, Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces. The sun rises in Aries on the 21st of March, and in a month after in Taurus, and so on through the signs in monthly succession.

[c] *Eclipse.*—This term is derived from a Greek word, which signifies a *leaving out* or deficiency; of course, in this case, of light. *Ellipse* is from the same root. See page 28.

[d] Of course, of the *principle* merely.

CHAPTER III.

CAUSES OF THE EARTH'S ANNUAL MOTION.

We shall now briefly explain the *causes* of the earth's motion round the sun. Let us suppose that the earth, at its creation, was projected forward into pure and boundless space, and it is certain[a] that if no obstacle occur to impede its

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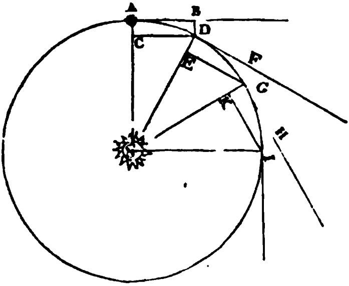
[a] It requires no argument to prove that, if a body is at rest, it must always remain so, unless moved from its position by the application of some force or power; but it appears strange and incredible, that if a body is set in motion, it must move on for ever, unless some obstacle occur to prevent it. This is clearly proved in the following illustration of an argument from Archbishop Whately's Rhetoric, page 70:—

"One part of the law of nature, called the 'vis inertiæ,' is established by the argument alluded to, (The Argument of Progressive Approach:) viz. that a body set in motion will eternally continue in motion with uniform velocity in a right line, so far as it is not acted upon by any causes which retard or stop, accelerate or divert, its course. Now, as in every case which can come under our observation, some such causes do intervene, the assumed supposition is practically impossible, and we have no opportunity of verifying the law by direct experiment; but we may *gradually approach* indefinitely near to the case supposed; and on the result of such experiments our conclusion is founded. We find that when a body is projected along a rough surface, its motion is speedily retarded and soon stopped; if along a smoother surface, it continues longer in motion; if upon ice, longer still; and the like with regard to wheels, &c., in proportion as we gradually lessen the friction of the machinery. If we remove the resistance of the air, by setting a wheel or pendulum in motion under an air-pump, the motion is still longer continued. Finding, then, that the effect of the original impulse course, it will move on in a straight line and with a uniform motion for ever; for, according to the laws of motion, *matter* has no more power to stop of itself when once put in motion, than it has, if at rest, to move of itself in any way. In the following diagram, let A represent the earth and S the sun,



and let us suppose that the earth, having been projected forward, is moving in a straight line with a velocity that would carry it on to B in the space of a month, while the attraction of the sun, under whose influence it has now come, would bring it to C in the same time. Now, as the earth is impelled by two forces acting perpendicularly to each other, it is certain that it will obey neither the one nor the other, but like a ball struck at the same instant by opposite forces, it will move in a direction between them. It will not, however, like the ball, move in a straight line, or, as it is said, describe the diagonal of a parallelogram; because as the power of attraction continues to act upon the earth, without ceasing, it continually draws it out of the straight line, and thus converts its course into a *curve*. This is exemplified in the parallelogram A B D C, in the foregoing diagram. A D is the line described by the earth, in the same time in which it would have described either the line A B, or A C,

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is more and more protracted, in proportion as we more and more remove the impediments to motion from friction and the resistance of the air, we reasonably conclude that if this could be *completely* done (which is out of our power), the motion would never cease, since what appear to be the only causes of its cessation, would be absent."

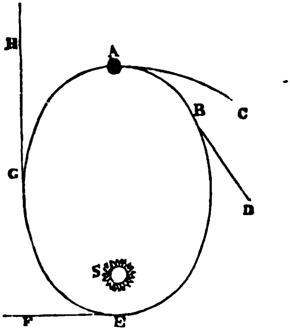
that is, according to our supposition, in the space of a month. A D is of course a curved line, but as every point of it may be considered as constituting the diagonal of an infinitely small parallelogram, the earth may be said to move as a ball would under similar circumstances. The earth is now at D, and its tendency is to move in a straight line to F in the space of a month, while the attraction of the sun would bring it to E in the same period of time. But, as before, the earth will follow neither the one impulse nor the other, but will move between them in the line D G, which it will describe in the same time in which it would have described either the line D F or D E, that is, in the space of a month. We have now the earth at the point G, and its tendency is to move in a straight line to H, in the space of a month, while the sun's attraction would carry it to K, in the same time. But the combined action of these two forces will, as in the foregoing cases, cause the earth to move between them in a curved line; that is, it will describe the line G I, in the parallelogram G H I K, in the same time in which it would have described either G H or G K.

We have now followed the earth from the point A to the point I, that is, through one-fourth of its orbit, which it has described in the space of three months; and it may be easily shown, by drawing lines at right angles, to represent the forces of projection and attraction, and by completing the parallelograms, that it will describe the entire circle in the course of twelve months.

We have now seen that the earth's motion round the sun in an orbit or circle, is caused by the combination of the force of projection and the force of attraction. The former of these forces is called the *centrifugal* force, because it impels the earth to *fly* from the sun in a tangent or straight line, touching its orbit; and the latter, the *centripetal*, because it causes the earth to *seek* or move towards the sun, or the *centre* around which it revolves.

What proofs of the Divine power and goodness these magnificent motions display! If the earth had been at the creation projected in the direction of, or *too near* the sun, its destruction would have been inevitable; or if it had been projected *too remote*, or in a line beyond the influence of the sun's attraction, the consequences would have been equally disastrous. And even now, if either of these motions were to prevail over the other, the result to our globe would be fatal. In the one case, it would be burned up and destroyed by falling to the sun; and in the other, it would fly off into infinite space never more to be warmed or enlightened by his rays.

And, strictly speaking, the centrifugal and centripetal forces do not in every part of the earth's orbit exactly counterbalance each other; and the consequence is, that the earth deviates from an exact circle, and describes what is called an *ellipse*[a] or oval. The annexed diagram, in which S represents the sun and A the earth, is an ellipse.



At A the earth is in APHELION, that is, in that part of its orbit most remote *from the sun*, and its motion or velocity will in consequence be slower. In this case, the force of attraction will begin to prevail, and the earth, instead of describing the circular arc, A C, as in the former diagram, will move nearer the sun in the elliptical line A B. At B the projectile or centrifugal force impels the earth in the direction B D, but the centripetal force continues to draw it nearer and nearer to the sun till it arrives at E. As the centripetal force increases as the earth approaches the sun, there appears to be some danger of the earth being drawn into it, particularly as the direction of the force of projection is no longer perpendicular to that of attraction, but inclines more nearly to it, and therefore counteracts it less. The earth, however, with a motion constantly increasing, arrives in safety at E, and all appearance of danger is over. For though the earth will be attracted most powerfully at E, being in PERIHELION, or in that part of its orbit which is nearest to the sun, the velocity which it has acquired in approaching the sun will increase its centrifugal force, so as to make it prevail over the power of attraction; and the earth will consequently move from the sun in the direction E G. In motion round a centre, the centrifugal force increases with the velocity of the moving body; or in other words, the quicker it moves, the stronger is its tendency to fly off in a straight line. When a stone is whirled round in a sling, for instance, its tendency is to fly off in a tangent to the circle it describes; and the quicker it is whirled round, the stronger, of course, is its tendency to fly off.

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[a] *Ellipse.*—This term is another form of the word *eclipse,* and primarily means a *leaving out.* In making an ellipse, we leave out as it were a part of the radius, not giving the full sweep of the compasses, as in a circle. An elliptical orbit and an elliptical sentence have each something *left out.*

Thus at E in the diagram, the centrifugal force of the earth is at its maximum, in consequence of the increased velocity which it has acquired in approaching the sun, and its tendency, therefore, will be to fly off with accelerated speed in the direction E F—that is, away from the dangerous proximity of the sun. But this equally dangerous tendency is kept in check by the centripetal force which at this point is also at its maximum; and the consequence is, that the earth moves in the curved line E G. As at the point E the two forces act perpendicularly to each other, we might expect that the earth, as in the preceding diagram, would move in the arc of a circle; but *notwithstanding the proximity of the sun*, the centrifugal force predominates here, and the earth is, in consequence, dragged away in the elliptical line E G. At G the centrifugal power impels the earth in the direction G H, while the centripetal force draws it towards S, and the consequence is, that it moves between them in the line G A; and in describing this line, the earth will travel slower and slower till it arrives at A; because its motion is always retarded in proportion as it recedes from the sun. When the earth arrives at A its velocity is so diminished that the centripetal force, though it also is at its minimum here,[a] begins to predominate over the centrifugal, and the earth will, in consequence, continue to move in the course already described.

But great care should be taken to inform the pupils that the orbit of the earth, though an *ellipse*, differs little in reality from a *circle*. The representation of it in this diagram has been purposely given *in excess*, in order that a clearer view might be had of the causes which retard or accelerate the motion of the earth in receding from, or approaching to the sun. The longer diameter or axis of the earth's orbit is only about one-sixtieth part longer than its shorter axis—from which it follows that the orbit itself differs very little from a circle. The one-sixtieth part of the axis of the earth's orbit, however, is about three millions of miles, which, of course, is the difference in the distance of the earth from the sun when in *aphelion* and *perihelion*. But even this immense distance amounts to almost nothing when compared to the entire distance of the earth from the sun—namely, ninety-five millions of miles. That this is so, follows from the fact that the earth is actually nearer the sun in the cold of winter than in the heat of summer.[b] This may appear surprising and even incredible, but it is easily explained. The *longer* the sun is above the horizon, and the *more direct* his rays are, the more heat he communicates, and the reverse of this is equally evident. Now the *days* are *longer* in summer than in winter, and the rays of the sun, in consequence of his higher elevation in the heavens, shine upon our part of the earth *more directly*; which two causes *more* than counterbalance the proximity of our hemisphere to the sun during the winter half-year.

In further illustration of this, it may be observed, that during the *polar* summer the sun is for months above the horizon, and yet the temperature is never great, because the rays of the sun strike the earth very *obliquely*, in consequence of his low elevation in the heavens. Again, the sun is at the same distance[c] from us when rising or setting, as he is when on our meridian, and yet we all know that it is much warmer in the middle[a] of the day, than it is either in the morning or evening. The cause,[b] of course, is the greater directness of the sun's rays when on the meridian.

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[a] The centripetal force is, of course, least powerful when the earth is in *aphelion*.

[b] That is, in the *northern* hemisphere.

[c] Because every point of the immense concave or hollow *hemisphere* of the heavens, is at the same distance from the *centre*, at which every spectator imagines himself to be situated.

CHAPTER IV.

MAGNITUDE AND MEASUREMENT OF THE EARTH.

Having explained the figure and motions of the earth, we have now to show how its MAGNITUDE has been determined.

As the earth is a *spherical* body, its magnitude will depend upon the length of its DIAMETER[c] and CIRCUMFERENCE.[d] But how can the length of either be ascertained? We cannot follow a straight line through the centre of the earth, from side to side, to ascertain its length; nor can we even travel round the surface of the earth in a circle[e] to measure its circumference. Nor is it necessary to attempt either. For, as the circumference of the earth, like every other circle,[f] is conceived to be divided into 360 equal parts, or degrees, it is evident, that if we can ascertain the length ot any one of these parts, we have only to multiply it by 360, to find the length of the entire circumference. And as the proportion between the diameter of a globe and its circumference is known to be nearly as one to three, it is plain that the circumference of the earth will give us the length of its diameter. For example, it has been ascertained by actual measurement that the length of a degree on the earth's surface is about 69$\frac{1}{10}$ English miles, which, multiplied by 360, gives nearly 25,000 miles for the whole circumference; and as the diameter of a globe or circle is something less than one-third of the circumference, it follows that the diameter of the earth is about 8,000 miles in length.

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[a] Strictly speaking, the greatest warmth is not in the middle of the day, but in two hours or so after, because the heat continues to *accumulate* for some time after the sun has reached the meridian; just as midsummer is not the hottest part of the year, but two months or so after. With regard to the COLD at *midnight* and *midwinter*, similar observations may be made.

[b] A *contributing* cause is, that the more direct the sun's rays are, the less of the atmosphere they have to travel through in reaching the earth.

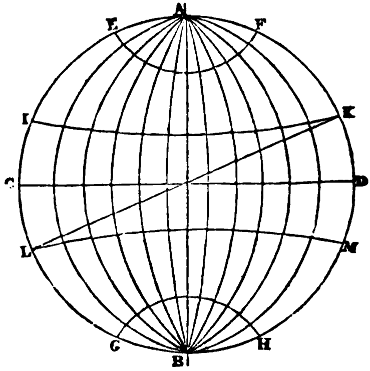
[c] *Diameter*, from the Greek words *dia*, through, and *metreo*, to measure. A diameter *measures* a globe or circle *through* the centre, from any point in the circumference to the point opposite.

[d] *Circumference*, a line or circle *carried round* the surface of the earth, so as to divide it into two equal parts or halves.

[e] Of course in a *great* circle.

[f] See page 24, for the origin of the division of the circle into 360 degrees.

But how is a degree on the earth's surface measured? The process is easily understood, but it requires a previous knowledge of the CIRCLES which, for the purpose of measuring the earth's surface, and determining the position of places, astronomers have supposed to be drawn round both the CELESTIAL and TERRESTRIAL SPHERES.



In this figure, which represents on a *plane* surface *one-half* of the terrestrial sphere, C D is the one-half of the equator, which, as we mentioned before, is a circle supposed to be drawn round the middle of the earth, or at an equal distance from each pole. As the plane of the equator passes through the centre of the earth, it divides it into two equal parts, and is, consequently, A GREAT CIRCLE. The half of the globe above or *north* of the equator is called the NORTHERN HEMISPHERE, and the half below or *south* of the equator is called the SOUTHERN HEMISPHERE. The word hemisphere means *half* of a *sphere* or globe.

A and B are the POLES of the earth, or its extreme *northern* and *southern* points; and the line A B, which passes from pole to pole through the centre of the earth, is its AXIS. For a full explanation of the *poles* and *axis* of the earth, see page 14.

The LATITUDE of a place is its distance from the *equator*. If a place is *north* of the equator, it is said to be in NORTH LATITUDE, and if *south*, in SOUTH LATITUDE. It is evident, that the entire *northern* hemisphere is in north latitude, and the entire *southern* hemisphere in south latitude.

But to say, that a place is in north or in south latitude, gives little or no idea of its precise position. In fact, it is merely saying, that it is either in the northern or southern hemisphere or *half of the globe*. Its precise distance not only from the equator, but from the FIRST MERIDIAN, must be ascertained.

A line drawn due *north* and *south* through any place, is called its MERIDIAN; and if it is continued round the globe,[a] it forms a CIRCLE called a MERIDIAN. As these circles run due north and south, it is evident, as in the diagram, that they must all pass through the extreme northern and southern points of the earth's surface; or in other words, through the POLES. These circles are called *meridians*,[b] because, as the earth turns on its axis, when any one of them is opposite to the sun, it is *mid-day*, or noon along that line.[c]

The meridians, like all other circles, are conceived to be divided into 360 equal parts or degrees. *Half* of a meridian circle, therefore, contains 180 degrees, and the *quarter*, of course, ninety degrees. Now, the distance from the equator to each pole is evidently the fourth part of a meridian circle, and consequently, ninety degrees.

We have now a measure for the *latitude* or distance of a place from the equator, namely, the QUADRANT, or *fourth* part of a meridian circle. This quadrant, of course, passes over the place; and as it is divided into ninety equal parts or degrees, we have only to reckon the number of the parts, intercepted between the place and the equator, to ascertain the exact latitude. If there be 10, 20, or 45, for instance, then we say, that the place is 10, 20, or 45 degrees, north or south latitude, as the case may be. The brass ring in which a terrestrial globe is hung, is called the *universal* meridian, because, by turning the globe round, every place on its surface can be brought under this meridian, and its distance from the equator or its latitude thus ascertained. With this view, this circle is divided into four quadrants of ninety degrees each.

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[a] The one *half* of the circle is usually called the meridian, and the other *half* the *anti-meridian*.

[b] *Meridian* is derived from a Latin word (*meridies*) which signifies the *middle* of the *day*.

[c] For ninety degrees north and south of the point over which the sun is perpendicular, that is, for half of the circle. See page 22.

In a MAP of the world the circles which run *parallel* to the equator enable us to determine the exact latitude of places; and hence they are called PARALLELS OF LATITUDE. As these circles are parallel to the equator their direction is *east* and *west*, and though every place, in the least degree *north* or *south* of any of these circles, might have a parallel of latitude passing through it, yet in most maps only sixteen are described—eight north and eight south of the equator. By these eight circles in each hemisphere, the meridian quadrants are divided into nine equal parts of ten degrees each; the first circle being ten degrees from the equator, and the last ten degrees from the pole.

When we wish to find the exact latitude of any place, we have only to look at its position with regard to a *parallel of latitude*. If the parallel runs through it, let us follow the line to either side of the map, and the latitude will be found marked in degrees; and if the parallel runs a little above or a little below the place, we have only to follow its course or curve to either side of the map, and the latitude will be found marked in like manner.

But it would be of little use to know the latitude of a place unless we knew its LONGITUDE also.[a] *Longitude* is the distance of a place *east* or *west* from the FIRST MERIDIAN. The first meridian on our maps passes through Greenwich, in the vicinity of London; and other nations, in like manner, reckon their longitude from their respective capitals; as the French from Paris, and the Spaniards from Madrid.

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[a] The terms LONGITUDE and LATITUDE—that is, *length* and *breadth*—are inapplicable to a *spherical* body; but when they were first applied to the earth it was supposed to be a flat or plain surface, extending farther from *west* to *east* than from *north* to *south*. Hence, from west to east they called *longitude*, and towards the north and south, *latitude*. A map of the world, "as known to the ancients," shows this clearly.

There is no natural or peculiarly appropriate place to commence longitude from, as there is for latitude—namely, the circle which passes round the middle of the earth, *equidistant* from each pole, or, in other words, the EQUATOR.

As longitude is the distance of a place *east* or *west* from the first meridian, it is measured on the circles which run east and west—namely, the *equator* and *parallels of latitude*; for, as the parallel circles are made to assist in determining latitude, so the meridians are employed in enabling us to ascertain the longitude. But the equator is made to serve as a general measure of longitude; and for this purpose it is always graduated or divided into 360 equal parts or degrees. If a place is on the equator, its longitude is found by reckoning the number of degrees on the arc of the equator intercepted between the place and the first meridian. If there be 10, 20, or 75 degrees, for instance, then the place is 10, 20, or 75 degrees east or west longitude as the case may be. But if the place is north or south of the equator, which, of course, almost every place is, its longitude is measured on the *parallel of latitude* which passes through it. But instead of actually measuring the arc of the parallel intercepted between the place and the first meridian, we take the *corresponding arc of the equator*, and reckon the degrees upon it. It is in this way that the meridians are made to assist in determining the longitude of places. Instead of *graduating*

From north to south, little more than the northern parts of Africa and the southern and central parts of Europe are given, and from west to east, ("*Gadibus usque ad Auroram et Gangem*")—from the Straits of Gibraltar (*Pillars of Hercules*) to India beyond the Ganges. The MEDITERRANEAN sea is in the *middle* of the *earth*, as known to the ancients; and hence its name, *middle* of the *earth*, not middle of *the land*—a name by which the Baltic and other seas might as well have been called. But with regard to the propriety of the terms *longitude* and *latitude*, as applied to the earth, it may be observed that, *strictly speaking*, they are correct; for the earth is actually *longer* in the direction of *longitude* than it is in the direction of *latitude*—its *equatorial* diameter being longer than its *polar* by about twenty-six miles. See page 40.

each of the parallel circles for the purpose of reckoning the longitude of the places over which they pass, we have only to follow the curve or course of their meridians[*] to the equator, and count the number of degrees upon the corresponding arcs. The corresponding arcs of the equator, and parallels of latitude, are included between the meridians which run through them, at right angles, from pole to pole; and it is evident that each of them contains the same number of degrees; for the circles of which they are equal parts, like all other circles, contain 360 degrees each. But, though each of these corresponding arcs contains the same number of degrees, it is evident that the arcs themselves, and consequently the degrees marked upon them, are of unequal length. The length of a degree depends upon the magnitude of the circle, of which it is the 360th part. If the circle be 360 miles, or feet, or inches in circumference, a degree, or the 360th part of it, will be a mile, a foot, or an inch, as the case may be. Now, as the equatorial circle is evidently greater than any of the circles parallel to it, a degree on the former must be longer than a degree on any of the latter. The length of a degree on the equator is sixty geographical, or about $69\frac{1}{10}$ English miles; the length of a degree on a parallel of latitude, therefore, is less; and, as the parallel circles get smaller and smaller in proportion to their distance from the equator, it follows that the 360 degrees, into which each of them is conceived to be divided, get less and less in the same proportion, till at the poles they diminish to mere points.

The degrees of *longitude*, therefore, are of unequal and constantly varying length—because they are the 360th parts of *unequal* circles, namely, the *parallels of latitude;* while for a similar reason, the degrees of *latitude* are all equal—because they are the 360th parts of *equal* circles, namely, the meridians. In reducing the degrees of *latitude* to miles, therefore, we have to multiply them by sixty for geographical, and by $69\frac{1}{10}$ for English miles; while the degrees of *longitude*, except *at the equator*, must be multiplied by a less and constantly decreasing number. As the length of a degree of longitude evidently depends upon the distance of the place from the equator, there is a table in almost every treatise on Geography[a] showing the length in miles of a degree of longitude at every degree of latitude. For instance, at sixty degrees north or south latitude the length of a degree of longitude is stated to be thirty miles. If we wish, therefore, to reduce the degrees of longitude to miles in latitude sixty degrees, we must multiply them by thirty; and if the latitude of the place is more than sixty degrees, of course we must multiply by a less number than thirty.

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[*] If a meridian does not pass through the place, follow the curve or course of *the nearest*, and make the necessary allowance for the difference [illegible] and the meridian of the place.

Another difference between latitude and longitude is, that the former is counted only *quarter* round the earth—namely from the equator to the poles; while longitude is reckoned east and west from the first meridian *half* round the earth. The greatest latitude, therefore, that a place can have is ninety degrees north or south, while longitude may extend to 180 degrees east or west from the first meridian. It is evident that the extremes of latitude are the poles of the earth, each of which is ninety degrees distant from the equator, north and south, and consequently 180 degrees asunder. But the extremes of longitude, like many other extremes, meet at the same point—for it is evident that if two persons travel half round the world, setting out from the same place, the one due east and the other due west, they will meet at the same point. It is obvious, therefore, that places 180 degrees east, or 180 degrees west longitude, are under the same meridian.

We have stated that the degrees of latitude are all equal, because they are the 360th parts of equal circles, namely, the meridians; but strictly speaking, this is not entirely correct. Our great philosopher, Sir Isaac Newton, held that the earth, in consequence of its motion round its axis, was an *oblate* and not a *prolate* spheroid, as was maintained by some of the continental astronomers.[b] By an oblate spheroid was meant that the earth was flattened in the direction of the poles, and protuberant about the equator; and actual measurements of the earth's surface have proved that this is the case. For instance, it has been ascertained that a degree of a meridian near the polar circles is rather more than half a mile longer than a degree of the same meridian near the equator; from which it follows that the earth's surface must be flatter in the direction of the poles than it is about the equator. For the longer a degree is, the greater is the circle of which it is a 360th part, and the greater the circle, the less is its curvature, or, in other words, the more nearly it approaches to a *straight* line, and consequently *the flatter is the surface* which it bounds or passes over. If a surface is perfectly *flat* it is evident that a line bounding or lying along it is perfectly *straight;* and if a surface is curved, a line bounding it follows the curvature, and is consequently curved in proportion.

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[a] See page 48 for this table.

[b] We have seen (page 25) that the tendency of a body in motion is, to move forward in a *straight line*. Hence the constant effort of a body moving round a centre to fly off in a tangent to the circle it describes. A sling, or a stone fastened to the end of a string and whirled round, exemplifies the principle. If the string breaks, or is let go, the stone flies off in a straight line or tangent to the circle it described while revolving. Hence, as the earth revolves on its axis, every particle on its

The degrees of latitude, therefore, in consequence of the flattening of the earth about the poles by its *rotatory* motion, are a little longer in proportion to their distance from the equator; while the degrees of longitude, on the contrary, get less and less in that direction, till, at the poles they diminish to mere points. But the difference between the

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surface has a constant tendency to fly off in a tangent to the circle it describes, and the farther the particle is from the centre of motion, the stronger is its tendency to fly off, because the greater is the velocity with which it is moving. Particles about the *equator,* therefore, have a stronger tendency to fly off than particles in the direction of, or about *the poles;* because as they describe greater circles in the same time, their velocity is greater. Hence, from the greater effort of the particles about the equator to escape, the earth is bulged out or protuberant in that direction; and for a similar reason the parts about the poles, where the rotatory motion is least, are flattened in proportion. This principle may be familiarly illustrated by dipping a mop in water and twirling it round. When taken out of the water it is lumpish and shapeless; but, if twirled briskly round, its parts diverge, the water flies off *in drops* and *in tangents* to the circle it describes, and it assumes the form of an OBLATE SPHEROID. Again, if a flexible hoop be made to revolve with rapidity about a diameter, it will become flattened about the top and bottom, where the rotatory motion is least, and protuberant or bulged about the middle, where the rotatory motion is greatest. In other words, the figure which the hoop describes will be an OBLATE SPHEROID.

degrees of latitude is so slight, that generally and *practically* speaking, it may be said they are all equal.

But how is a degree on the earth's surface measured? At page 4, we have shown that in consequence of the *spherical* surface of the earth, the polar star appears to a person travelling due north or south, to ascend, or descend in the heavens, in proportion to the space passed over. Upon this fact, a most important principle in Geography is established, namely, that the latitude of a place in the northern hemisphere, always corresponds to the altitude of the polar star; and hence, to ascertain our distance from the equator, in the Atlantic Ocean, for instance, we have only to take the altitude of the polar star, and our latitude is determined. If the polar star, for instance, is 10, 20, or 53 degrees above the horizon, we may conclude with perfect certainty that our distance from the equator is 10, 20, or 53 degrees, as the case may be.

To make this perfectly clear, suppose we were at the north pole of the earth, our distance from the equator or *latitude* would be ninety degrees; and the distance of the polar star from the horizon, or its *altitude*, would be ninety degrees also; for in that position it would appear in our *zenith*, or right above our heads; and consequently, ninety degrees above the horizon. Now, suppose we travel ten degrees in the direction of the equator,[a] or due south, our distance from the equator would be diminished from ninety to eighty degrees; and the polar star would appear to have descended in the heavens in the same proportion, that is, our *latitude* and its *altitude* would be each eighty degrees. If we travel twenty, or thirty, or any number of degrees, under *ninety*, due south, from the pole towards the equator, our latitude and the altitude of the polar star will be found to decrease in proportion. *Half-way* between the pole and the equator, for instance, our latitude will be forty-five degrees, and the altitude of the polar star forty-five degrees also; and if we travel to the equator, there will be *no latitude*, because we are no distance from it; neither will the polar star have *any altitude*, for it will, in this case, be on the horizon.

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[a] It is obvious that if we move at all from our supposed position, it must be in the direction of the equator, or to the *southward*. In the same way, if a person move from the *south pole*, no matter in what direction, it will be *northward*.

This simple and beautiful principle in Geography, not only enables us, even in the middle of unknown seas, to ascertain our position on the earth's surface with regard to the equator, but it also furnishes us with the means of measuring the surface, and determining the magnitude of the earth.

As our latitude (Dublin) is 53° 23′, the altitude of the polar star above our horizon, is the same number of degrees and minutes, namely, 53° 23′. Now, if we travel due north, or due south, till we find that the polar star has increased or decreased a degree in altitude, it is evident, from what has been said, that we have travelled a degree on the earth's surface. And if we measure the distance between the point of departure, and the place from which the polar star seems to have increased or decreased a degree in altitude, making due allowance for elevated ground, we have the length of a degree, or a 360th part of the circumference of the earth—and, if we multiply by 360, the ENTIRE CIRCUMFERENCE. The length of a degree on the earth's surface is found by actual measurement to be about $69\frac{1}{10}$ English miles,[a] which, multiplied by 360, gives about 24,890 miles for the entire circumference; and, as the diameter of a globe or circle is something less than one-third of the circumference, we conclude that the length of the DIAMETER OF THE EARTH is about 8,000 miles.[b]

The latitude of a place may also be found by the MERIDIAN ALTITUDE of the sun, or its height above the horizon at twelve o'clock, on any day of the year. For every circle supposed to be drawn on the earth, there is a corresponding circle on the heavens. The equator of the earth, for instance, corresponds to, and if extended to the heavens would coincide with, the celestial equator. Hence, if we were at the equator of the earth, the celestial equator would be in our zenith, that is, directly over our heads. In such a position, it is evident that our zenith would be no distance from the celestial equator, because it would be in it; nor would we be any distance from the terrestrial equator, because we are supposed to be at it.

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[a] The length of a degree of a meridian in latitude 45 degrees, is found by actual measurement to be 69 miles, 79 yards, which may be taken as the mean length of a degree on the earth's surface. A degree on the same meridian farther northward or southward will, in consequence of the oblate figure of the earth, vary a little in length. At the Arctic circle, a degree is about 386 yards more, and at the equator, about 558 yards less, than at the parallel of 45 degrees.

[b] The polar diameter, in consequence of the flattening of the earth at the poles, and its protuberance about the equator, is less than the *equatorial* diameter by about 26 miles. The *mean* diameter of the earth is 7,912 miles. See page 38.

It is also evident, that if we move from the equator towards either pole, that is, north or south, our zenith distance from the celestial equator will increase in proportion to the space passed over; for, as the whole distance between the celestial equator and the poles of the heavens corresponds in the *number* of degrees to the whole distance between the terrestrial equator and the poles of the earth, (the former being the *fourth* part of a celestial, and the latter, the *fourth* part of a terrestrial meridian,) it follows that a corresponding part of the one will be equal, in the *number* of degrees, to a corresponding part of the other. Hence, if a person, setting out from the equator travels due north ten, twenty, or any number of degrees, a right line from his head to the heavens would describe an equal number of degrees on the corresponding celestial meridian. In other words, his ZENITH DISTANCE from the celestial equator will be equal (in the *number* of degrees) to his distance from the equator, that is, to his LATITUDE. If he travelled *ninety* degrees, for instance, north from the equator, his zenith would be the same number of degrees north from the celestial equator; for, in such a position, the pole of the heavens would be directly over his head, and the celestial equator in his rational horizon.

It is evident, from what has been said, that the latitude of any place may be found by determining its zenith distance from the celestial equator. But how is this done? If the equator were marked on the heavens, as it is upon an artificial globe, we could at once determine the latitude of any place, by measuring the arc of the meridian intercepted between the zenith of that place and the equator. But though the equator is invisible, its exact position in the heavens is easily ascertained. For if the sun is *north* of the equator, as he is from the Vernal to the Autumnal Equinox, we have only to subtract his DECLINATION[a] from his *meridian* altitude to find the altitude of the equator; and having thus found the height of the equator above the horizon, we have its distance from the zenith of the place in which the observation is made, and consequently, the latitude, for we have only to subtract the altitude of the equator from *ninety* degrees, (the whole distance between the horizon and the zenith), and *the difference* will be the zenith distance of the place from the equator which, as we have just seen, will give us the latitude. For example, suppose the captain of a ship at sea, north of the equator, finds by his quadrant that the altitude of the sun, at twelve o'clock on any given day, say the 21st of June, is 70 degrees, he subtracts the sun's declination for that day, namely 23½ degrees, from 70 degrees, and the difference 46½ degrees gives him the altitude of the equator. And having thus found the altitude of the equator (46½ degrees), he subtracts it from 90 degrees, and the difference (43½ degrees) will be his latitude.

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[a] The sun's DECLINATION, that is, his distance from the equator,

But if the sun is *south* of the equator, his declination for the day is to be *added* to his meridian altitude, to find the altitude of the equator, which having found he proceeds as before. And when the sun is in the equator, as on the 20th of March, and the 22nd of September, his meridian altitude will at once give the altitude of the equator; for in these cases, there is no declination to be either added, or subtracted.[a]

We have seen how latitude may be found without the aid of maps and globes, even in the middle of unknown seas; and we have now to show how longitude may be ascertained under similar circumstances.

As the earth turns once round on its axis before the sun

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is calculated for every day in the year, and inserted in the Nautical Almanac. *Declination* on the heavens corresponds to *latitude* on the earth.

[a] On the same principles the latitude of a place may be found by taking the meridian altitude of the moon, or of any fixed star whose *declination* is known, (and the declinations of the principal stars are known and inserted in the Nautical Almanac). Should the zenith distance of the sun, moon, or star, when on the meridian, be taken, instead of the altitude, it will evidently amount to the same thing; for if we know the distance of any body from the zenith we have only to subtract it from 90° to find its distance from the horizon; that is, its altitude. The zenith distance is more convenient on *land*, because from the inequalities of the earth's surface, it is difficult to obtain a true horizontal boundary.

in twenty-four hours, every point on its surface, except the poles, describes a circle[a] or 360 degrees in that time. And as the earth turns round from *west* to *east*, it is evident, that places to the *east* will be turned to the sun sooner than places to the *west;* and the proportion will be, an hour for every fifteen degrees. For as the earth turns once round, or describes 360 degrees in twenty-four hours, it will in one hour turn round the twenty-fourth part of 360 degrees, that is, fifteen degrees. *Fifteen* degrees, therefore, on the earth's surface, from east to west, correspond to *an hour* of time. To persons residing fifteen degrees *east* of us, the sun will rise, reach the meridian, and set, an hour earlier than with us; and their time will, in consequence, be an hour before, or in advance of our time. When it is 6, or 12, or 8 o'clock with us, for instance, it is an hour more with them, that is, 7, or 1, or 9 o'clock, as the case may be. To persons living twice fifteen degrees to the east of us, the difference in time will be two hours; and so on in the proportion of one hour for every fifteen degrees—or, which is the same thing,[b] four minutes for every degree. To persons living to the west of us, the reverse of this is the case.[c] Their time is *after* ours in the same proportion, namely, four minutes for every degree, or one hour for every fifteen degrees.

Hence, by knowing the difference of the longitudes of any two places, we can at once determine the difference in their time; and in like manner, by knowing the difference in their time, we can determine the difference in their longitudes. On most globes and maps there is a meridian drawn through every fifteen degrees of longitude, in all twenty-four meridians, to correspond with the twenty-four hours of the day; and if we wish to ascertain the difference in the time of any two places, we have only to count the number of meridians between them, each of which corresponds to an hour. At the place to the *east*, the time will be quicker, in the proportion of an hour for every meridian,[a] or four minutes for every degree.

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[a] See note, page 38.

[b] *As* the earth turns 360 degrees in twenty-four hours, it will turn *one* degree in the 360th part of twenty-four hours, that is, in four minutes. Or, in other words, as the earth turns fifteen degrees in an hour, in the fifteenth part of an hour, that is, four minutes, it will turn one degree.

[c] Or rather, it is the same thing; we live to the *east* of them and therefore, our time comes earlier.

We are now supplied with a principle which enables us, at sea, or in any unknown region of the earth, to determine our longitude, or distance east or west from the first meridian.

The CHRONOMETER, which we are supposed to bring with us, shows us London or first meridian time; and our own watches, as regulated by the sun, show us the time of the place in which we happen to be. Now, the difference between these times, that is, between the chronometer, set to London time, and our own watch, as regulated by the sun, enables us to determine our distance, east or west from the first meridian For, if the difference be one, or two, or three, or six hours, then our distance from the first meridian or longitude, will be fifteen, thirty, forty-five, or ninety degrees, as the case may be. And if our time is in advance of, or before London time, then we are so many degrees *east* longitude; but if behind or slower, so many degrees *west* longitude. For, as we saw before, time comes *earlier* to the *east*, and later to the west. If when it is 12 o'clock by our watch, for instance, we look at the chronometer, and find that it is 10 o'clock by it, we conclude that we are twice fifteen, or thirty degrees to the *east* of the first meridian. But if in this case, it is one, two, or three o'clock by the chronometer, then are we fifteen, thirty, or forty-five degrees *west* of the first meridian.

In the case we have supposed,[b] the sun is opposite to us, or on our meridian; and as the meridian of London is, as shown by the two hours' difference in time, thirty degrees to the west of us, it is evident from what has been said, that it will be two hours before London, and the places in a line with it, north and south, will be in a similar position with regard to the sun. When by the earth's rotation this takes place, it will be 12 o'clock along the meridian of London, instead of 10; and instead of 12 with us, it will be 2 o'clock for we now shall have moved thirty degrees to the east of our former position with regard to the sun, that is, we shall have passed the meridian two hours ago. But if it be 2 o'clock by the chronometer, when it is 12 o'clock by us, the meridian of London must have been opposite the sun two hours before, as in this case we are thirty degrees to the west of it.

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[a] That is, for every fifteen degrees; a meridian being supposed to be drawn through every fifteen degrees of longitude. If a meridian be drawn through every ten degrees, it will, of course, represent forty minutes.

[b] That it is 12 o'clock by our watch, as regulated by the sun.

But as even the best chronometers fail to keep exact time, other methods for finding the longitude have been sought. The eclipses of Jupiter's satellites enable mariners to ascertain London or first meridian time, and thus to determine their longitude. In the Nautical Almanac the precise times in which the several satellites appear eclipsed to a spectator in London are calculated for two or three years in advance, so as to serve for long and distant voyages, and inserted in a table composed for the purpose. And hence, when a navigator wishes to regulate his chronometer, or to ascertain London time, he watches for an eclipse of one of these satellites, and by comparing the time in which it becomes visible to him, with the time in which, according to his almanac, it is visible to a spectator in London, he is enabled to determine his longitude. For instance, if an eclipse, which is calculated in his almanac to appear to a spectator in London at 11 o'clock on a certain night, becomes visible to him at 8 o'clock the same evening, it is evident, as it will be seen by both at the same moment, that he is three hours behind London time, and consequently three times fifteen degrees to the west of the first meridian. But if he observe an eclipse taking place at 12 o'clock at night, for instance, which his almanac states will appear in London at 8 o'clock the same evening, it is evident that he is four hours in advance of London time, and consequently four times fifteen or sixty degrees to the eastward of the first meridian.[a]

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[a] What is said here is merely in illustration of the principle, as this method of finding the longitude is found to be impracticable at sea, in consequence of the motion of the vessel. For, in order to observe these eclipses, it is necessary that the telescope should be perfectly steady. Besides it would be requisite, either that the vessel should remain at the place at which the time was regulated by the sun, till the eclipse occurred; or that the distance she may have moved *east* or *west* during the interval should be known and taken into account. The eclipses of the moon and of the sun are better adapted for this purpose, but they are of rare occurrence.

The longitude at sea may be found when the moon is visible, by

We have seen how the circumference, diameter, and general magnitude of the earth have been determined; and we have been made acquainted with the means by which the relative and actual positions of places on its surface may be ascertained — we shall now show how the distance between any two places on globes or maps may be found.

If the places are on the *same meridian*, but in different hemispheres, we have only to multiply the sum of their latitudes by 60 for geographical, or by $69\frac{1}{10}$[a] for English miles to find the distance between them. For instance, if one of the places is 20° north, and the other 10° south of the equator, the distance between them in degrees of *latitude* is evidently 30, which, multiplied by 60, gives us 1,800 geographical, or, by $69\frac{1}{10}$, about 2,080 English miles. If the places are on the same meridian, and in the same hemisphere, the difference between their latitudes, multiplied by 60 for geographical and $69\frac{1}{10}$ for English miles, gives us the distance between them. For instance, if one of the places is 10° and the other 30° north latitude, we have only to subtract 10 from 30, and multiply the difference as before.

If the places are on the *same parallel*, their distance from each other in *degrees* is found in like manner — that is, by adding their longitudes, if in different hemispheres — or by subtracting them from each other, if in the same hemisphere. But their distance in *miles* is found not by multiplying by sixty[b] as in reducing the degrees of *latitude*, but by the number of miles contained in a degree of longitude on that parallel under which the places in question lie.[c] For instance, if one of the places is ten degrees east, and the other

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taking her angular distance from the sun, or from one of nine conspicuous stars which lie near her orbit or path. The distance of the moon from the sun, and from these nine stars, is given in the Nautical Almanac for every three hours of Greenwich time; and the general principle is, that the difference between Greenwich time as noted in the Almanac, and the time at the place where the longitude is sought, when converted into degrees, will be the longitude of the ship. This is called the LUNAR METHOD of finding the longitude.

[a] Or, in round numbers, by seventy, the result, of course, will be a little in excess.

[b] If for geographical miles.

[c] The number of miles in a degree of longitude in every latitude is found in the table mentioned, page 48.

twenty degrees west of the first meridian, it is evident that the sum of their longitude (10° E. + 20° W. = 30°) gives their distance from each other in degrees of longitude; but if the places are on the same side of the first meridian, the one say 20° and the other 40° east of it, it is equally evident that the difference in their longitude (40° — 20° = 20°) gives their distance from each other in degrees of longitude. And it is clear from what has been said that to reduce these degrees to *miles*, we must multiply not by 60, except *at the equator*, but by the number of miles contained in a degree of longitude in that particular latitude in which the places in question lie. By referring to the table, we find that the number of miles in a degree of longitude in our latitude (Dublin) is about 36 miles. If we wish, therefore, to find the distance in miles between Dublin and Manchester, for instance, which are nearly under the same parallel, we have merely to multiply the difference between their longitudes (6° 20′ and 2° 14′) by 36, and the result will be about 150 miles.

But when, as is generally the case, two places are on different parallels and different meridians, we have merely to take the distance between them with a pair of compasses or piece of tape, and measure it on the equator, or graduated side of the map. This will give us their distance in degrees, which, as they are degrees of a great circle, we may reduce to miles by multiplying by 60. We say degrees of a *great*[a] circle because it is evident that the shortest distance between any two points on the globe is an arc of the great circle which joins them; and we measure this arc on the *equator* or on a *meridian;* because, as all great circles are equal, it is immaterial which we adopt as a measure. For example, if the distance thus taken between two places on a globe or map is found when carried to the equator, or the graduated side of the map, to contain 10, 20, or 50 degrees, their distance in geographical miles will be 10, 20, or 50 multiplied by 60. In measuring the distance between any two places or points upon a map, we take care not to use the graduated scale at the top or bottom; for the degrees represented there are degrees of *longitude*, which, as we have seen, vary in length according to their distance from the equator. The graduated sides of a map, on the contrary, represent meridians—the degrees of which are all equal to 60 geographical or 69$\frac{1}{10}$ English miles. The *sides* of a map, therefore, should always be the scale by which the distance between any two places or points upon it must be measured.

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[a] *Great circle*—see page 21.

Before proceeding farther, the instructor should exercise his pupils in measuring, and calculating the distance between any two given points or places on the earth's surface, as laid down in their maps. The subjoined table will enable them to convert the degrees of longitude into geographical miles, which they can easily reduce to English miles. They should also be exercised in converting longitude into time, and *vice versa*.

TABLE, SHOWING THE LENGTH OF A DEGREE OF LONGITUDE ON ANY PARALLEL OF LATITUDE, BETWEEN THE EQUATOR AND THE POLES.

Degrees of Latitude.	Geographical Miles.	Degrees of Latitude.	Geographical Miles.	Degrees of Latitude.	Geographical Miles.
1	59·99	31	51·43	61	29·09
2	59·96	32	50·88	62	28·17
3	59·92	33	50·32	63	27·24
4	59·85	34	49·74	64	26·30
5	59·77	35	49·15	65	25·36
6	59·67	36	48·54	66	24·40
7	59·55	37	47·92	67	23·44
8	59·42	38	47·28	68	22·48
9	59·26	39	46·63	69	21·50
10	59·09	40	45·96	70	20·52
11	58·90	41	45·28	71	19·53
12	58·69	42	44·59	72	18·54
13	58·46	43	43·88	73	17·54
14	58·22	44	43·16	74	16·54
15	57·96	45	42·34	75	15·53
16	57·67	46	41·68	76	14·52
17	57·38	47	40·92	77	13·50
18	57·06	48	40·15	78	12·47
19	56·73	49	39·36	79	11·45
20	56·38	50	38·57	80	10·42
21	56·01	51	37·76	81	9·39
22	55·63	52	36·94	82	8·35
23	55·23	53	36·11	83	7·31
24	54·81	54	35·27	84	6·27
25	54·38	55	34·41	85	5·23
26	53·93	56	33·55	86	4·19
27	53·46	57	32·68	87	3·14
28	52·98	58	31·80	88	2·00
29	52·48	59	30·90	89	1·05
30	51·96	60	30·00	90	0·00

CHAPTER V.

ZONES — CLIMATES — TEMPERATURE.

We have seen[a] that, in consequence of the inclination of the earth's axis, and its constant direction to the same point in the heavens during the entire annual revolution,[b] the northern and southern hemispheres are enabled to enjoy in their turn an equal portion of the light and heat of the sun. But though both hemispheres, generally speaking,[c] enjoy an equal portion of light and heat, yet in the hemispheres themselves there is a great diversity of temperature, in consequence of the rays of the sun striking the surface *directly* in some parts and *obliquely* in others. In those parts of each hemisphere which lie near the equator, the rays of the sun strike the surface more directly, and these regions are, in consequence, excessively warm; while in the direction of, and about the poles, in both hemispheres, the sun shines more and more obliquely, and the consequence is, that the temperature in these parts of the earth becomes less and less in proportion.

Hence the division of the earth's surface into ZONES, and its subdivision into CLIMATES. The word zone means a *girdle* or belt, and the term climate a *gradation*. The zones are five in number — namely, one TORRID, two TEMPERATE, and two FRIGID. The torrid zone encompasses the middle or warmest part of the earth; and hence its name *torrid*, which implies excessive heat. This division of the earth extends to 23½ degrees on each side of the equator, and consequently comprehends a large and equal portion of both hemispheres. Through the northern limit of the torrid zone the tropic of Cancer is conceived to be drawn, and through the southern, the tropic of Capricorn. The torrid zone, therefore, lies between the tropics, and the sun is, consequently, always vertical or over head in some part of it.

The north temperate zone lies between the tropic of Cancer and the Arctic circle, and the south temperate, between the tropic of Capricorn and the Antarctic circle. Each of these zones, therefore, is 43 degrees broad. Except in those parts which lie near the equator and polar circle, neither the heat nor cold is in excess; and hence these great divisions of the earth's surface have been denominated the *temperate* zones.

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[a] See pp. 13 and 21. [b] See note, p. 22. [c] See p. 49

The frigid zones extend from the polar or Arctic and Antarctic circles to the poles, and are consequently 23½ degrees broad each. In these regions of the earth the cold is excessive, particularly about the poles; and hence they have been designated the *frigid* zones. The extreme cold of the frigid zones is occasioned by the total disappearance of the sun during the winter; and the great obliquity of his rays during the summer of their year.

The extent of the zones in degrees will not, it is evident, give us their real magnitudes; but the following estimate will enable us to form an idea of their relative sizes. It has been estimated that if the entire surface of the earth were divided into 100 equal parts, the torrid zone would contain about 40; each of the temperate about 26, and each of the frigid zones about 4 of these parts. The inhospitable and frozen regions of the earth, therefore, are almost nothing when compared to the habitable parts of it.

The division of the earth's surface into zones was found though *natural*[a] and appropriate, to be too general, and hence its subdivision into *climates;* which may be regarded as *small zones* or girdles, encompassing the earth from the equator to the poles. The different lengths of the days in different latitudes is the principle upon which this division was founded. At the equator, as we have seen,[b] the days and nights are equal throughout the year—that is, they consist of 12 hours each; but if we recede from the equator, north or south, this equality will cease to exist. When the sun is north of the equator the days are longer than the nights in the northern hemisphere; and when the sun is south of the equator the reverse of this is the case; and in the southern hemisphere, of course, similar changes take place.

At the equator the day is always 12 hours long, but at 8° 34′ north or south of it, the length of the day extends to 12½ hours. Now, if we conceive parallels of latitude to be drawn through those points of the earth's surface which are 8° 34′ distant from the equator north and south, we have inclusive the first climate in each hemisphere. Again, at the distance of 8° 10′ more, or in latitude 16° 44′ north and south, the length of the day is found to be *half an hour* longer—that is, 13 hours; and here, the boundary of the second climate, in each hemisphere, is conceived to be drawn. And, as the day increases from 12 hours at the equator to 24 hours at the polar circles, it is evident that there are 24 climates between the equator and each of the polar circles, for in every place where the day is longer by *half an hour* a new climate is conceived to commence. But from the polar circles to the poles, the climates are reckoned not by half-hours but by *months;* for in these latitudes the sun, during the summer, is for months above the horizon. From the polar circles to the poles, therefore, there are six climates. in each of which the days exceed each other in length by an entire month.

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[a] See page 22 for the *natural* position of the TROPICS and POLAR circles, the boundaries of the zones.

[b] See page 20.

But it should be observed that, since the introduction of the parallels of latitude, the division of the earth into climates is little regarded — particularly as the temperature of a country is not always found to correspond with its climate or the length of the day. The south of Labrador and north of Ireland, for instance, are in the same climate — that is, the length of the day and the distance from the equator are the same; yet the temperature or degree of heat enjoyed by these countries is very different. In Table Bay, in Labrador, latitude 54°, the *mean* temperature is stated to be 32 degrees — that is, at the freezing point; while in the same latitude in Ireland the mean temperature is nearly 50 degrees.[a]

The general principle, therefore, that the temperature of a place is in proportion to its latitude or distance from the equator, is subject to great modifications. If a place is situated in mountainous or elevated regions — or in the proximity of unreclaimed countries or frozen seas, it will be found much colder than its latitude or distance from the equator would lead us to expect. But if, on the other hand, a place is in the vicinity of parched and sandy deserts, or in sheltered and sunny valleys, its temperature will be much higher than its distance from the equator would lead us to infer.

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[a] In Dublin, latitude 53° 23′, the mean temperature is about 50 degrees.

The city of Quito, for instance, though in the middle of the torrid zone, enjoys a moderate temperature, not exceeding in the mean, it is stated, 53 degrees; which is about the mean temperature of the city of New York in latitude 40° 42′; and of Amsterdam, which is still farther from the equator, namely, 52° 22′. The moderate temperature of Quito is owing to the elevation of the plain[a] in which it is situated, and to the cooling effects produced by the snow-capped mountains which encompass it, such as Chimborazo and Cotopaxi.

The *northern* parts of North America and of Asia are instances of the chilling effects produced by unreclaimed soils—proximity to frozen seas—and exposure to cold bleak winds.[b]

On the other hand, the north of Africa, the south of Europe, the Mediterranean Sea, Syria, and Asia Minor, in consequence of the heating effects produced by their proximity to the burning deserts of Africa and Arabia, have a much higher temperature than their respective latitudes would lead us to expect.

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[a] Upwards of 9,000 feet above the level of the sea.

[b] The *northern* parts of Asia and North America are greatly exposed to the polar winds. There are no mountains to protect them from their influence; and besides, in consequence of their *northern* aspect or declivity, the rays of the sun strike the surface more obliquely.

A declivity *towards the equator* on the contrary, increases the temperature, by presenting the surface more directly to the rays of the sun. "If the sun, when *on* the meridian, is 45 degrees, for instance, above the horizon, his rays fall *perpendicularly* on the side of a hill facing the south at an equal angle while the plain below receives them at an *angle of 5 degrees.* Supposing the north side of the hill to have a similar slope, the rays would run *parallel* to its surface, and their effect be very trifling; but if the declivity were still greater, the whole surface would be in the shade."—*Library of Useful Knowledge.*

Hence in selecting a farm, a field, or a garden, one with a southern, or rather a south-western aspect, should be preferred; because it receives the rays of the sun *more directly*, and during the warmest part of the day. For a similar reason, a farm with a north-eastern aspect should not be chosen. In the Vallais, in Switzerland, it is stated, that the Alps are, on the north and north-eastern sides, covered with perpetual snow, while vineyards and orchards flourish on the opposite sides. And we have all felt how much warmer the south side of a hill is than the northern, or north-eastern side.

Periodical and *prevailing winds* have a great effect upon climate. When they come from *warmer* regions, they increase the temperature of the countries over which they pass; and when they come from *colder* regions, they decrease the temperature in proportion.[a]

Large tracts of water, also, have considerable effect upon climate. The temperature of water is much more equable than that of land; and hence, islands and countries adjoining seas, have a much more uniform climate. In summer, their temperature is lower, and in winter higher, than their respective latitudes would lead us to expect; and hence, the difference between an *insular* and *continental* climate, though equally distant from the equator. For instance, though Edinburgh and Moscow are nearly in the same latitude, their climates are very different. In Edinburgh, the heat of summer and the cold of winter, are modified by its insular position, and its general temperature is, in consequence, much more equable than that of any place in the same latitude having a continental situation. In Moscow, for instance, the cold in winter is sometimes so intense as to freeze quicksilver, and in summer, the days are often as hot as at Naples. The thermometer at Moscow ranges, it is stated, from 10° in winter to 67° in summer, while in Edinburgh it varies from about 28° to 59° during the year.

The climate or general temperature of a place, therefore, cannot, except in a general sense, be determined by its distance from the equator. To know it accurately, we must be made acquainted with its particular situation, and the local influences to which it is subject.

To give a more distinct view of the distribution of heat over the globe, the celebrated traveller Humboldt has, from observations and experiments made by himself and others in different parts of the world, traced a number of ISOTHERMAL[b] is a regular zone, extending 20° on each side of the equator. The mean temperature of this region varies from 81° in the middle, to 78° on the northern and southern borders. 2. The region of the *sugar-cane*, in which the mean temperature ranges from 78° on the *equatorial* border to 68° on the opposite. 3. The region of the *olive* and *fig*, which comprises all those parts of the earth's surface where the mean temperature ranges from 68° to 59°. 4. The region of the *wine-grape*, which is comprised between the isothermal lines of 59 and 50 degrees of mean temperature. 5. The region of the *oak* and *wheat*, which lies between the isothermal lines of 50 and 41 degrees of mean temperature. 6. The region of the *fir*, *pine*, and *birch*, which is comprised between the isothermal lines of 41 and 32 degrees of mean temperature.[a] 7. The region of the *lichens* and *mosses*, which are found after every other species of vegetation ceases.

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[a] "In the United States, the winds often produce, alternately, the cold of the polar regions, and the warmth of the Gulf of Mexico — the moisture of the ocean, and the dryness of the land." — *Woodbridge's Geography.*

[b] *Isothermal,* from two Greek words, which signify of *equal heat* or temperature.

Of course, it is not to be supposed that the plants and vegetables here specified are confined to the regions which have been called by their names. All that is meant is, that, as they respectively require a certain temperature to bring them to maturity, we are to expect them, *in perfection*, in those parts of the earth only in which the specified temperature is found.

In ascending a lofty mountain, particularly in a warm country, we may expect to meet with the plants and vegetables of different climates, as the temperature in such cases is generally found to decrease in proportion to the elevation of the surface. If the mountain be near the equator, about its base we may expect to find the *aromatic* trees of the torrid zone; on its sides the *sugar-cane* and *coffee-tree* of the tropics; higher up, the *olive* and *fig* of Spain, Italy, and Turkey; higher still, the *vines* of France and Germany; next, the *oaks*, *elms*, and *beeches* of England and the north of Europe; next, the *firs* and *pines* of Scotland and Scandinavia; and lastly, the *lichens* and *mosses* of Lapland. Of course, such a regular succession of VEGETABLE ZONES is not to be expected; but, generally speaking, a lofty mountain, in a warm region, will, from its base to its summit, exhibit the appearances of different zones and climates. On the Peak of Teneriffe, Humboldt met with, and has described five of such zones. And "Tournefort, about the base of Mount Ararat, found the ordinary plants of Armenia; a little way up, those of Italy; higher again, those which grow about Paris; afterwards, the Swedish plants; and higher still, those of Lapland." And Etna has been often described by travellers as exhibiting from its base to its summit the extremes of climate and vegetation.

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[a] "In Lapland there are pine forests on the continent at Enontekeis, where the mean annual temperature is only 27 degrees; while on the island of Mageroe, where it is more than 32 degrees, only a few scanty shrubs are to be seen. The more vigorous vegetation of Enontekeis, is the effect of a warmer summer; the mean temperature of July being there 59½°, whereas at the isle of Mageroe it is only 46¾°."—*Library of Useful Knowledge.*

We shall conclude the subject of temperature with a few observations on the SNOW-LINE. The snow-line, or *the line of perpetual congelation*, is the imaginary line which marks the height at which *perpetual snow* begins. The height of this line depends upon the latitude, and the other circumstances which affect and modify temperature. Generally speaking, it is highest in the torrid zone, from which it gradually descends till it touches the surface in the polar or *frozen* regions. The following table will give a general idea of the height of the snow-line in different latitudes in the northern hemisphere.

HEIGHT OF THE SNOW-LINE IN DIFFERENT LATITUDES.

Latitude.	Mean Temperature.[*]	Height in Feet.
0°	81°	16,000
10°	81°	16,500
20°	78°	17,000
30°	71°	14,000
40°	62°	10,000
50°	53°	6,000
60°	45°	5,000
70°	38°	1,000
80°	33°	0

It appears from the foregoing table, which, however, should be regarded only as a general approximation to the truth, that if a person in the middle of the torrid zone is elevated 16,000 feet above the level of the sea, he will find himself, as far as cold and climate are concerned, transported to the frozen regions of the frigid zone. It appears also, which seems rather surprising, that the snow-line is higher at the distance of 20 degrees from the equator, where we would expect it to descend, than it is in the middle of the torrid zone. But the reason of this is obvious. At the equator, the sun is never more than 12 hours above the horizon, while in the vicinity of the tropics, the days, during the summer, are about 13¼ hours in length; which, as the sun is vertical, or nearly so, during that period, causes the temperature to be higher than at the equator, and consequently, increases the elevation of the snow-line.

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[*] At the level of the sea.

But why, it may be asked, should the heat decrease in proportion to the elevation of the surface? One would think that it should be warmer at the top than at the bottom of a mountain, seeing that it is nearer to the sun, and more exposed to his rays. But five miles, the height of, perhaps, the highest mountain in the world, amount to nothing when compared to the immense distance of the sun from the earth; and it is well known, that there is often as much, and even more heat from the reflected, than there is from the direct rays of the sun. When the rays of the sun strike upon the earth, they accumulate about the surface;[a] and are thence reflected into the air, and diffused about the objects around. Hence, in valleys and plains, the heat is greater than it is on mountains and elevated surfaces in the same locality. In the one case, the heat accumulates about the surface, and is diffused about the air and the objects near it; while in the other, the heat is reflected into the thin, clear air, which surrounds the mountains, and is dispersed by the winds which sweep over them before it has time to accumulate.

Generally speaking, we should expect the snow-line to be lower in the southern hemisphere, than in the northern, in equal latitudes; because the southern is colder than the northern hemisphere; but not, perhaps, so much so, as is generally believed. Humboldt says, that near the equator, and indeed through all the torrid zone, the temperatures of the two hemispheres appear to be equal; but that the difference begins to be felt in the Atlantic, about 22° of latitude; the mean temperature of Rio Janeiro and Havannah, places at about an equal distance from the equator (23°), being in the latter instance 76° 4′, and in the former 74° 5′ In Patagonia, between 48° and 52° of latitude, the temperature of the warmest month is said not to exceed 42 degrees; while at Petersburgh, in latitude 60°, it is 66°; and in Van Diemen's Land, the summers are 10 degrees colder than they are in Italy in the same latitude. But, as we are prepared to expect, from what has been said on the difference between an insular and continental climate in the same latitude, the winters are milder in Patagonia and Van Diemen's Land, than they are in the corresponding latitudes in Russia and Italy.

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[a] The more impervious the surface is to the rays of the sun, the greater will be the reflected heat. Hence, in walking along the paved streets of a town, we feel much warmer than we should if walking through a field in the country. The reflection of the rays from the walls or sides of the houses increases the heat reflected from the street.

No inhabited land has been discovered in the southern hemisphere beyond 54° or 55° of latitude; while in the northern hemisphere, the habitations of men are found several degrees beyond the 70th parallel. Snow has been seen to fall at the Straits of Magellan in the middle of summer; and the island of South Georgia, in latitude 56°, is covered with perpetual snow.

Three causes have been assigned for the difference in temperature between the northern and southern hemispheres. First, the great disproportion between the water and the land in the southern hemisphere, which causes its climate to differ from that of the northern, in the same way as an insular climate differs from a continental one, in the same latitude. Secondly,[a] as the sun is nearly eight days in the year longer on the northern side of the equator, than he is on the southern, a greater quantity of heat is distributed in the northern hemisphere than in the southern. And thirdly, as almost all the ice that is formed about the south pole escapes, and is carried by the currents towards the equator,[a] the cold which it gives out as it gradually approaches warmer latitudes, cools the atmosphere and lessens the temperature in proportion. The ice from the north pole, of course, has a similar effect upon the northern hemisphere, but much of the ice that is formed there is hemmed in by the land, and prevented from escaping.

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[a] That portion of the earth's orbit which lies above the sun, or north of the equator, contains about 184°; that under the sun, or south of the equator, about 176°; and hence the sun, in the course of the year, is nearly eight days longer in the northern than in the southern hemisphere. Or, in other words, the time between the vernal and autumnal equinoxes is about seven days seventeen hours longer than the period between the latter and the former. This arises from the *elliptical* form of the earth's orbit and from the earth's being in *aphelion* in summer.

CHAPTER VI.

MOUNTAINS, PLAINS, AND DESERTS.

At first view, **MOUNTAINS** appear to be irregularities on the earth's surface; but a little consideration will convince us that they were destined to perform an important part in the economy of nature. Their beneficial effects upon *climate* and *vegetation*, in countries exposed to a vertical sun, we have already spoken of; and we have now to add, that mountains form an essential part of the *aqueous* machinery of nature, by which the earth is refreshed and fertilized. Mountains intercept the clouds in their passage through the air, and by attracting, condense and cause them to fall, in rain, hail, or snow, according to the temperature and state of the atmosphere. All the moisture produced in this way penetrates through the pores and fissures of the mountains, and is collected in subterranean cavities and internal reservoirs; and hence the origin of springs, brooks, and rivers. For when these subterranean reservoirs overflow, the water issues out in springs, which, following the declivity of the ground, unite their streams with others, and thus gradually swell into brooks and rivers. If there were no such elevations on the earth's surface, the moisture deposited upon it by the process of evaporation would in dry and sandy soils be entirely absorbed; while in others, it would saturate the surface, and produce swamps and morasses.

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[a] See page 80.

Again, without mountains, the mineral treasures of the earth would have been beyond the reach of man.

"If," as has been said, "the strata of the earth had enveloped it like a shell, or to use a familiar example, had they surrounded it like the coats of an onion, it is clear that we should never have become acquainted with any other than the upper members of the series; and that the beds of coal and salt, and the ores of the metals, all of which are confined to the inferior strata, could never have been made available for the purposes of man."

Now, the mountains, those great eruptions of nature, have, by breaking up the crust of the earth, and by displacing the upper strata, brought within the reach of man those mineral treasures to which otherwise he never could have penetrated.

The novelty and beauty given to the landscape, by the varying form and diversified scenery of hill and dale, and mountain and valley, are too obvious to dwell upon. How different would the face of nature be, if the surface of the earth were one unbroken and monotonous plain!

We shall conclude our observations upon mountains, by directing attention to the following excellent article on this subject from a popular publication:[a]—

"The hills are the bones of a country, and determine its form just as the bones of an animal do. For according to the direction of the hills, must be the course of the rivers. If the hills come near the sea, it makes the rivers very short, and their course very rapid; if they are a long way from the sea, it makes the rivers long and gentle. But rivers of the latter sort are generally navigable, and become so large near the sea as to be capable of receiving ships of large size. Here then towns will be built, and these towns will become rich and populous, and so will acquire popular importance. Again, on the nature of the hills depend the mineral riches of a country; if they are composed of granite or slate, they may contain gold, silver, tin, and copper; if they are composed of the limestone of Derbyshire or Durham, they are very likely to have lead mines; if of the sand or gritstone of Northumberland, Lancashire, and Yorkshire, it is probable that there will be coal at no great distance. On the contrary, if they are made up of the yellow limestone of Gloucestershire, Oxfordshire, and Northamptonshire, or of chalk, like the hills in Wiltshire, Berkshire, and Hampshire, or of clay, like those about London, it is quite certain that they will contain neither coal nor lead, nor any valuable mineral whatsoever. But on the mineral wealth of a country, and particularly on its having coal or not having it, depends the nature of the employment of its inhabitants. Manufactories are sure to follow coal; whereas in all those districts of England where there is no coal, that is, in all the counties to the south-east of a line drawn from the Wash in Lincolnshire to Plymouth, there are, generally speaking, no manufactories, but the great bulk of the people are employed in agriculture.

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[a] *Penny Magazine.*

"Thus, then, on the direction and composition of the hills of a country, depend, first of all, the size and characters of its rivers. On the character of its rivers depend the situation and importance of its towns, and its greater or less facilities for internal communication and foreign trade. And again, on the composition of the hills, depend the employment of the people, their number on a given space, and in a great degree their state of morals, intelligence, and political independence."

To facilitate the study of this important branch of Geography, we have arranged and CLASSED the principal mountains of the globe, in the order of their height, according to the best and most recent authorities. We have also added the estimated length of the principal mountain-chains or ranges.

MOUNTAINS ARRANGED IN THE ORDER OF THEIR HEIGHT.[a]

Twelve Classes.

First Class.—Mountains upwards of 25,000 feet above the level of the sea, and less than 30,000: as several peaks of the Himalehs,[b] and one of the Andes (Sorata, 25.400).

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[a] With regard to the elevation of several of the following mountains, the authorities differ. This is not surprising, as, with few exceptions, it is only in Europe that accurate measurements have been taken. The pupils should not be required to learn the names, &c., of the mountains by *rota*. See note, page 71.

[b] The Dhawalagiri (28° 30′ north latitude, and 83° 30′ east longitude,) attains 26,862 feet above the level of the sea; and Chamalari (28° north latitude, and 89° 30′ east longitude) is probably but little lower. The Jawahir (30° 22′ north latitude, and 79° 57′ east longitude,) rises 25 749 feet. There are, probably, above 200 summits which rise more

Second Class.—Mountains from 25,000 to 20.000 feet high; as several peaks of the Himalehs; two or three of the Andes; and the Hindoo Coosh or Indian Caucasus (20,000).

Third Class.—Mountains from 20,000 to 18,000 feet high; as Cayambe, 19,633; Antisana,*[a] 19,136; Cotopaxi,* 18,867; Polima, 18.436 (Andes); Elburz, 18,350 (Caucasus).

Fourth Class.—Mountains from 18,000 to 16.000 feet high; as Mount St. Elias, 17,836 (N. America); Popocatapetal,* 17,780 (Mexico); Ararat, 17,700 (Asia).

Fifth Class.—Mountains from 16,000 to 14,000 feet high; as Pichinca,* 15,931 (Colombia); Mouna Roa, 15,900 (Sandwich Islands); Mont Blanc, 15,668; Mont Rosa, 15,527 (Alps); Mount Fair-Weatber, 14,736 (N. America)

Sixth Class.—Mountains from 14,000 to 12,000 feet high; as Mount Ophir, 13,840 (Sumatra); Jungfrau, 13,730; Schreckhorn, 13,310; Ortler Spitz, 13,065 (Alps); highest peaks of the Camaroons, 13,000 (Africa); Peak of Teneriffe,* 12,200; the highest peaks of the Abyssinian Mountains.[b]

Seventh Class.—Mountains from 12.000 to 10,000 feet high; as the Simplon, 11,730 (Alps); Mulhacen, 11,678 (Sierra Nevada,[c] Spain); James's Peak, 11,500 (Rocky Mountains, N. America); Maladetta, 11,436 (Pyrenees); Miltsin (the highest peak of the Atlas range), 11,400;[d] Mont Perdu, 11,275 (Pyrenees); highest peak of Lebanon, 11,050; Etna,* 10,937; St. Gothard, 10,605 (Alps).

Eighth Class.—Mountains from 10,000 to 8,000 feet high; as the highest peaks of the Altai, Carpathian, Apennine, and Dofrine Mountains; Egmont (New Zealand), 8,150.

Ninth Class.—Mountains from 8,000 to 6,000 feet high; as Mount Sinai, 7,952; highest peak of the Blue Mountains

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than 18,000 feet above the sea, and are covered with eternal snow. In fact, the name *Himalaya,* or Himaleh, is merely a Sanscrit term for *snowy,* a circumstance of which Pliny was well aware when he says—*Imäus* incolarum lingua nivosum significante.—M'CULLOCH'S *Dictionary of Geography.* [Mount *Haemus* seems to owe its name to the same circumstance; and Mont *Blanc* is evidently the *white* or snowy mountain. Compare also Sierra *Nevada.*]

[a] The mountains thus marked (*) are volcanoes.

[b] The height of the Abyssinian Mountains has been greatly exaggerated. Mr. M'Culloch estimates the highest peaks of the Samen Mountains at from 12,000 to 13,000 feet.

[c] *Sierra.*—This term is applied by the Spanish and Portuguese, to mountains whose summits or peaks resemble the teeth of a *saw;* and *Nevada* means snowy. See preceding note on *Himaleh.*

[d] Miltsin is about 27 miles S.E. from the town of Morocco. The height of Mount Atlas also has been greatly exaggerated.

(Jamaica), 7,278; Mount Taurus, 7,715; Olympus, 6,600, Adam's Peak, (Ceylon,) 6,650; Mount Washington, (Alleghanies,) 6,650; highest peaks of the Cevennes and Auvergne Mountains, 6,500 (France).

Tenth Class.—Mountains from 6,000 to 4,000 feet high; as Parnassus, 5,850; Mount Ida, 5,800; Mount Pelion, 5,200; Mount Hecla,* 5,010; Helicon, 4,550; Ben Nevis (Grampian), 4,370; Cairn Gorm, 4,060; Mount Otter, 4,250 (Alleghanies); Mountains of Venezuéla, 4,500.

Eleventh Class.—Mountains from 4,000 to 3,000 feet high; as Vesuvius,* 3,978; Table Mountain (Africa), 3,582; Snowden (Wales), 3,571; Magillicuddy's Reeks, 3,410; Ben Lomond. 3,262; Helvellyn, 3,052; Skiddaw, 3,022 (Cumberland).

Twelfth Class.—Mountains from 3,000 to 2,000 feet high; as the Wicklow Mountains in Ireland; Diana's Peak (St. Helena), 2,710; Mount Carmel, 2,250; Mount Tabor, 2,053 (Palestine).

REMARKABLE ELEVATIONS.

Highest ascent in a balloon, (M.M. Biot and Guy Lussac, at Paris, in 1804,)—22,900 feet.

Elevation attained by M. Boussingault and Colonel Hall, on Chimborazo, in 1831, the greatest terrestrial height yet accomplished—19,699 feet.

Elevation attained by M.M. de Humboldt and Bonpland, on the same mountain, in 1803—19,332 feet.

Highest flight of the Condor on the Andes—21,000.

The farm of Antisana, on the Andes, the highest place inhabited by man—13,435 feet.

City of Quito, in South America—9,630 feet.

Santa Fé de Bogōta (Colombia)—8,615.

Convent of St. Bernard (Alps)—8,606.

City of Mexico (Mexico)—7,500 feet.

Lake of Titicaca (Bolivia)—12,795 feet.

ESTIMATED LENGTH OF MOUNTAIN CHAINS IN MILES.

The Andes, the Cordilleras or Mexican, and the Rocky Mountains, upwards of 10,000

The Altai Mountains, 5,000.

The Mountains of the Moon, probably 2,000.

The Ural, Atlas, and Himaleh ranges, about 1,500 miles.

The Dofrine Mountains, about 1,000.

The Caucasian range, the Alps, and the Apennines, from 700 to 600 each.

The Carpathian Mountains, about 500.

The Pyrenees, about 250.

PLAINS AND DESERTS.

When the earth's surface appears to any considerable extent level, or even slightly undulating, it is called a PLAIN.

Plains, according to the nature of the climate and soil, are either fertile or unfit for cultivation. In the British Islands, there are specimens of both kinds; of the latter, in our bogs, morasses, and heaths. But it is only in continents that we are to expect plains hundreds of miles in extent. The north and north-east of the European continent consists of, with few interruptions, one immense plain. This vast tract, which extends from the shores of the German Ocean to the base of the Uralian Mountains, comprises the Netherlands,[a] Denmark, Northern Germany, and almost all European Russia. The only elevations of note by which the surface of this vast plain is broken, are the Valdai Hills in Russia, the highest of which do not exceed 1,200 feet. But, with few exceptions, such as the *steppes*[b] of Russia, the *putzas*[c] of Hungary, and the marshy[d] and sterile tracts which are found in every country in Europe, particularly in those which border on the Baltic Sea and German Ocean, the European plains are fertile and cultivated. There is no plain in this continent of sufficient wildness and extent to deserve the name of DESERT. It is only in the other great divisions of the world that *deserts*, properly so called, are found.

The largest and most remarkable desert in the world, is the Sahara, or great African desert. It is, as its name imports, a vast *sea of sand*. Like the sea, too, its surface, when agitated by the winds, rises in waves, sometimes mountain-high; which, as they often move with great rapidity, have been known to overwhelm whole caravans of travellers Sometimes the sands are raised by whirlwinds in the form of water-spouts, or moving pillars, whose tops reach almost to the clouds. Twenty or thirty of such pillars have been seen at once, moving in the same direction; and when they are seen between the spectator and the rising sun, their appearance is sublime and terrific beyond conception; for as his rays pass through them, they resemble immense moving pillars of fire![a] In fact, it is much more difficult and much more dangerous to cross the sea of sand than it is to cross the Pacific Ocean, which extends over half the globe. Nor would it be possible to cross it, but for the *oases*, or fertile spots, which are met with here and there, like islands in the ocean,[b]

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[a] *Netherlands*, that is, *low*, or rather *lower* lands; nether being the comparative of *neath*, as in be*neath*. The word HOLLAND has a similar signification, namely, *hollow*, or low land.

[b] The principal in Europe are, the steppes of Ryn, between the Volga and the Ural river; and the steppes of the Volga, between that river and the Don. Siberia, or Asiatic Russia, also abounds in steppes. It is remarkable that some of the steppes have, from the beds of sand, marine shells, and pools of salt water which they contain, all the appearance of the bed of the sea.

[c] *Putzas*, a marshy and swampy tract of country between the rivers Theiss and Danube, the extent of which has been estimated at 2,425 square miles. The great plain of Hungary, in which the putzas occur, is larger than the whole of Ireland!

[d] As the *Pontine marshes*, the *Campagna di Roma*, and the Tuscan *Maremma*.

———— the tufted isles
That verdant rise amid the Lybian wild.

At those happy spots, the parched and exhausted travellers refresh themselves and their camels—*the ships of the desert*, as they have been beautifully called. And here, too, they lay in fresh supplies of water, which is carried for the use of the caravan in large leathern bottles. The want of water is the great danger to which caravans are exposed; for their entire stock is sometimes dried up under the parching influence of winds[c] peculiar to the desert. When this occurs, unless a fountain is at hand to afford them a fresh supply, both men and camels die from thirst.[d] It sometimes happens, too, that they find the fountain from which they expected a supply of water dried up under the same influences. In 1805, a caravan proceeding from Timbuctoo to Tafilet, not having found water at a resting-place, the whole persons belonging to it, 2,000 in number, with about 1,800 camels, perished miserably!

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[a] As in the ocean nothing is seen in the horizon but an expanse of water, so in these immense deserts, nothing appears in view but a level expanse of sand; and as the sands are constantly shifting, there are no permanent land-marks to guide travellers in their course. They are, therefore, obliged to direct their course by the compass or the stars, as if they were at sea.

[b] The ancients compared the oases to the spots upon the leopard's skin. Much of the beauty and fertility ascribed to them, is evidently due to the contrast between them and the burning deserts by which they are surrounded.

[c] Such as the Simoom. See page 96.

[d] In such extremities, the camels are killed for the sake of the little water that may remain in their stomachs.

The deserts of Arabia, Syria, and Persia, are *Saharas* on smaller scales. We need not, therefore, stop to describe them. One distinguishing feature of the great desert in Persia is, that many parts of its surface are covered with saline incrustations, from which circumstance it is called the Great Salt Desert. The natives call it the *Deria Kuveer*, or salt sea; and the sandy wastes they call *sahra*. The Great Salt Desert is upwards of 700 miles in length.[a]

In Hindostan there are extensive sandy deserts between the Indus and the branches of the Ganges; but they are not of so desolate a character as those which have been described

In Central Asia, which consists of an immense PLATEAU OR TABLE-LAND, is the great desert of Gobi or Cobi; in the middle of which is the Shamo, or *sea of sand*. The length of the great desert of Cobi is about 1,200 miles, and the breadth from 500 to 700. Through the middle, for the whole of its length, extends the Shamo, or sand sea, varying in breadth from 150 to 250 miles. The great elevation of this desert, and its greater distance from the equator, preserve it from the scorching heats of the *saharas* of Africa and Arabia; but it is equally destitute of vegetation and water, and camels only can be used in crossing it.

In America there are immense plains and extensive deserts. The vast tract included between the Rocky and Alleghany Mountains on the one hand, and the Gulf of Mexico and the Great Lakes on the other, may be regarded as one immense plain. The southern portion of this vast plain is exceedingly fertile, but the western and north-western parts of it abound in deserts, SAVANNAHS, and PRAIRIES. In the western part of this plain, between the Ozark and Rocky Mountains, is the great American Desert. Its average breadth is about

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[a] It commences on the north at the base of the Elburz mountain, in about the 36th degree north latitude, and uniting with the desert of Kerman, extends south to about the 30th degree; on the other hand, it extends from about the 51st to the 60th degree of longitude, occupying all the central and eastern parts of the country. It has a few oases, or fertile spots, but they do not amount to five per cent. of its extent. — M'CULLOCH's *Dictionary of Geography.*

400 miles, and it extends along the base of the Rocky Mountains as far as we have any acquaintance with that range. That portion of it which is traversed by the Platte river has, it is said,[a] a strong resemblance to the barren steppes of Asia. The soil and rocks are saline, and incrustations of salt often appear on the surface, and the plants are such as are usually found in saline tracts. Trees and forests are almost unknown. This waste is scorched in summer by the rays of the sun, and chilled in winter by freezing winds from the mountains.

The *savannahs* and *prairies* are generally covered with a species of coarse grass, which often grows to the height of a man.[b] They are numerous in the states which border on the Ohio and Mississippi rivers, particularly between the latter river and the Rocky Mountains; and in the western part of the state of New York, several prairies of small extent occur. The other vast plains in America, are the basins of the Amazon, the La Plata, and the Orinoco. In these plains extensive savannahs occur. In the rainy season they are clothed with vegetation and verdure, but in times of drought they assume the appearance of deserts.[c] In Venezuela they are called LLANOS, and in Buenos Ayres, PAMPAS. The llanos of Venezuela extend 200 leagues along the Orinoco river, from its mouth to the foot of the Andes; and the pampas of Buenos Ayres stretch out to an immense extent between the Paraguay river and the Andes. Immense herds of wild cattle range over those boundless plains.

Among the *plateaus* or *table-lands* in America remarkable for their height, may be mentioned that of Titicaca,[d] which comprises an area of 18,000 square miles, with a mean elevation of 13,000 feet above the level of the sea. The populous and well-cultivated plateau of Quito is elevated about 9,600 feet; and the extensive plateau or table-land of Anahuac, in Mexico, from 6,000 to 9,000 feet.

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[a] Woodbridge's Geography.

[b] The savannahs and prairies, particularly about the Rocky Mountains, abound with herds of bisons, &c.

[c] There is something awful, but sad and gloomy, in the uniform aspect of these steppes (of Venezuela). Every thing seems motionless. The plains all around us seem to ascend towards the sky; and the vast and profound solitude appeared to our eyes like an ocean covered with verdure. The first aspect of the llanos excites scarcely less astonishment than the lofty peaks of the Andes.—HUMBOLDT.

[d] Titicaca, partly in Bolivia and partly in Peru.

CHAPTER VII.

RIVERS AND LAKES.

RIVERS, as was shown in the preceding chapter, have their origin in mountainous and elevated regions.[a]

The magnitude and character of rivers, generally speaking, depend upon the elevation of the mountains from which they derive their source, and the extent and nature[b] of the country drained by them and their tributaries. This will be evident, if we look at the BASINS, or extent of country drained by the American, and other great rivers, as represented on globes and maps. The extent of country drained by the Amazon and its branches, is nearly equal to the whole continent of Europe; and the basins of the Mississippi and La Plata are also of vast extent, though neither of them amounts to half the magnitude of the basin of the Amazon. It is almost unnecessary to observe, that the mountain-ranges from which the great rivers of America derive their sources, are the most extensive, and among the most elevated in the world. In the Old World also, it will be found that the great rivers have their origin in the principal mountain-ranges.[c]

The velocity of rivers is, generally speaking, in proportion to the declivity of the ground over which they flow. When they meet with sudden declivities, RAPIDS are formed; when with abrupt or precipitous descents, CASCADES and CATARACTS.

The velocity of rivers is also accelerated by the quantity or volume of the water which they convey. Hence, the deeper a river is in proportion to its breadth, the quicker is its motion; for the greater will be the pressure of the particles of water from behind, upon those that precede. In fact, it is the pressure of the particles of water upon each other, not only from behind, but from above[d] also, that often carries rivers along level and extensive plains. Thus the Amazon, for the last 200 leagues of its course, has a descent of only 10½ feet, that is $\frac{1}{27}$th part of an inch for every 1,000 feet of that distance. And the Paraguay, for a considerable part of its course, descends only $\frac{1}{33}$rd of an inch in a mile.

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[a] Some rivers are at once formed by the overflowings of lakes.

[b] *Nature* of the country — that is, according to the humidity of the soil and climate.

[c] See page 71 for examples.

[d] The pressure of the particles from above, or, in other words, the force of gravity alone, will cause water to flow in a horizontal bed. Hence,

Most of the large rivers discharge their waters into the sea by several mouths; as the Nile, the Ganges, the Volga, the Niger, the Orinoco, and the Rhine. Some have only one mouth, as the La Plata, and the St. Lawrence. The mouth or estuary of the La Plata is 150 miles wide!

Some rivers are subject to periodical floods; as the Nile, the Ganges, the Indus, and the Mississippi. Those floods are produced by the heavy rains which fall during the wet season, particularly in the torrid zone, and by the annual melting of the snow on the mountains from which the rivers derive their sources. The annual overflow of the Nile was considered a mystery by the ancients, because, in Egypt, no rain ever falls. But—"Nature well known, no prodigies remain,"—the periodical overflow of the Nile is no longer considered a mystery.

The floods of rivers, particularly in the torrid zone, are often most destructive to life and property. The great flood of the Ganges, in 1822, destroyed, it was estimated, from 50,000 to 100,000 persons, and swept away several entire villages. At the same time, these floods serve to irrigate and fertilize soils, which would otherwise be sterile and unproductive, by spreading over them deposits of vegetable mud and slime. It is thus that Egypt is rescued by its noble river from the sands of the Lybian desert;[a] and to the *gladdening* and happy effects produced by its floods, the ancient Euphrates is indebted for its name.[b]

CLASSIFICATION OF RIVERS.

The principal RIVERS in the world may be divided into

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the velocity of the water in a river or canal may be accelerated by increasing the depth, without adding to the breadth.

[a] The Nile, which marks the extent of fertility by the measure of its inundations.—GIBBON.

[b] From a Greek word, which signifies to *make glad*.

> ———————— Sparsus in agros,
> *Fertilis* Euphrates, Phariæ vice fungitur unda.—LUCAN.

TEN CLASSES, according to their length,[a] as in the following table:—

First Class.—Rivers between 3,000 and 4,000 miles long; as the Amazon, 3,350; the Mississippi, with the Missouri, 4,000.

Second Class.—Rivers between 2,000 and 3,000 miles long; as the Yang-tse-kiang or Kiang-ku, 2,900; the Nile, 2,750; the Hoang-ho, 2,630; the Obi, 2,550; the Yenessei, 2,500; the Niger, 2,300; the La Plata, with the Paraguay, 2,300, the Volga, 2,040; the St. Lawrence (from Lake Superior), 2,000; the Mecon or Cambodia, 2,000; the Arkansas, 2,000.

Third Class.—Rivers from 2,000 to 1,500 miles in length; as the Amour or Saghalien, 1,900; Mackenzie's River, 1,900; the Danube, 1,800; the Orinoco, 1,800; the Madeira, 1,800; the Euphrates, 1,800; the Indus, 1,700; the Ganges, 1,650; the Brahma-putra, 1,600; the Irawaddy, 1,600; the Rio Bravo, or del Norte, 1,500.

Fourth Class.—Rivers from 1,500 to 1,200 miles in length; as the La Platte, Red River, Columbia, Nelson's River, and the Tocantins, about 1,400 miles each; the Ohio, 1,200; the Oxus or Jihon, 1,200.

Fifth Class.—Rivers from 1,200 to 1,000 miles in length; as the Dnieper, 1,100; the Don, 1,040; the Tenessee, Yellow, Stone River, St. Francisco, Colorado, Uraguay, Pilcomayo, and the Parana, about 1,000 miles each.

Sixth Class.—Rivers from 1,000 to 800 miles in length; as the Sihon or Jaxartes, the Senegal, and the Tigris, about 950 each; the Gareep or Orange River, 900; the Sutledge, 900; the Meinam or River of Siam, 850; the Rhine, 840; the Magdalena, 800; the Godavery, 800.

Seventh Class.—Rivers from 800 to 600 miles in length; as the Jumna, 780; the N. Dwina, 750; the Gambia, 700; the Dniester, 700; the Elbe, 680; the Vistula, 650; the Susquehanna, 620; the Loire, 620.

Eighth Class.—Rivers from 600 to 400 miles long; as the Oder, 580; the Theiss, 570; the S. Dwina, 570; the Tagus, 550; the Niemen, 515; the Meuse, 511; the Bog, 470; the Rhone, 460; Guadiana, 460; the Seine, 450; the Save, 450;

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[a] The authorities are no more agreed about the lengths of rivers, than they are about the heights of mountains. Nor is it to be expected that they should; for the sources of many of them are still unknown. Except for the *European* rivers, the lengths given are, for the most part, mere estimates. The learner should be required to trace these rivers on the maps of the countries through which they flow, from their *mouths* to their *sources*; noting their *tributaries*, the towns built upon them, &c. See note [a], page 62.

the Weser, 440; the Pruth, 430; the Po, 410; the Douro, 410; the Ebro, 400; the Garonne, 400.

Ninth Class.—Rivers from 400 to 300 miles long; as the Connecticut River, 380; the Drave, 380; the Guadalquiver,[a] 340; the Delaware, 320; the Hudson, 300; the Glommen, 300; the Mayne, 300; the Tornea, 300.

Tenth Class.—Rivers from 300 to 200 miles in length; as the THAMES, the SHANNON, the Severn, and the Tiber, about 200 miles each.

LAKES.

LAKES may be classed into FOUR distinct kinds. The *first* class consists of those which neither receive nor give out streams of water. Lakes of this class are usually very small, and are supposed to be the *craters* of extinct volcanoes.

The *second* class consists of those which receive no running water, but which give out rivers or streams. Such lakes are formed and fed by springs and internal reservoirs.

The *third*, and largest class of lakes, consists of those which both receive and give out rivers or streams of water as the great American lakes; the lakes of Ladoga, Onega, Constance, Baikal, &c. Several lakes of this kind may be considered as expansions of the rivers which flow through them. The great lakes of North America, for instance, may be considered as expansions of the St. Lawrence; Geneva, of the Rhone; Constance, of the Rhine; Lake Dembea, of the Abyssinian Nile; Loughs Allan, Ree, and Derg, of the SHANNON.

The *fourth* class consists of those which receive streams, and often large rivers, but which have no *visible* outlet; as the Caspian Sea, the Sea of Aral, and Lake Tchad, in Africa. The superfluous waters of such lakes are carried off, either by *evaporation* or by *subterranean* channels.

Lakes of the FOURTH class are usually salt, as the Caspian Sea, the Sea of Aral, and Urumea, one of the largest lakes in Persia. In hot countries, and in the dry and desert regions of Asia, Africa, and America, salt lakes are often found, which, *evaporating* during the hot season, leave saline incrustations upon their beds, by which the natives are abundantly supplied with salt.

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[a] *Guadalquiver*, the ancient Boetis. The Arabs gave it this name, which means *the great river*; for so it must have appeared to them. In the arid plains of Arabia there are no rivers deserving the name; nor in Northern Africa, from which they passed over into Spain.

Some lakes contain *natron* or *soda*, which collects on the bottom. The most celebrated are the six Natron lakes of Egypt, which furnish large quantities for commerce. In Maracaybo (South America) there is a lake which deposits more than 1,000 lbs. in two years, which is taken up from the bottom by Indian divers. There are some lakes of this nature in Hungary.

Some lakes appear and disappear periodically; as Lake Cirknitz in Illyria, and Lake Xarayes on the Paraguay river. The latter, from this circumstance, has been often drawn and effaced on the maps of South America. The appearance and disappearance of such lakes are produced by the increase or diminution of the sources from which they derive their waters.

We shall conclude this chapter by giving the *estimated* areas of the principal lakes in the world, in English miles.

ESTIMATED SIZE OF LAKES.

Lakes.	Area in Square Miles.	Lakes.	Area in Square Miles.
Caspian Sea,	120,000	Dembea,	1,130
Sea of Aral,	40,000	Wetter,	840
Lake Superior,	24,000	Mæler,	760
Baikal,	20,000	Lake Van,	560
Huron,	19,000	Dead Sea,	340
Michigan,	15,000	Palte,	300
Tchad,	12,500	Geneva,	240
Slave Lake,	11,800	Constance,	200
Gt. Bear Lake,	10,300	Garda,	180
Winnipeg,	8,000	Maggiore,	150
Erie,	8,000	Balaton,	150
Ladoga,	6,330	Lough Neagh,	102
Ontario,	5,500	Neufchatel,	66
Nicaragua,[a]	4,800	Como,	54
Titicaca,[b]	4.000	Lomond,	21
Onega,	3,380	Ness,	15
Wener,	2,135	Windermere,	7½

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[a] *Nicaragua*, lies principally between the 11th and 12th degrees of north latitude, and the 84th and 86th of west longitude; about 12 miles in a direct line from the Pacific, and 90 miles from the Caribbean Sea, with which it is connected by the River St. Juan. The junction of the Atlantic and Pacific oceans, by means of this lake and river, has often been proposed.

[b] *Titicaca*, the largest of the South American lakes, is 12,795 feet above the level of the sea.

CHAPTER VIII.

TIDES AND CURRENTS.

TIDES, or the alternate flowing and ebbing of the sea, are produced by the attraction of the moon and sun, but principally by the attraction of the moon. For the moon being so much nearer to the earth than the sun, has a much greater attractive influence on its waters than the sun.

The ancients looked upon the flowing and ebbing of the tides as one of the greatest mysteries in nature; and but for the more than human intellect of Newton, it is probable that it would have remained a mystery to this day.[a]

The phenomenon of the tides has been observed in every part of the earth which is washed by the sea. For about six hours the sea gradually swells, so that it enters the mouths of harbours and rivers, and comes nearer to the coasts. This is called FLOOD TIDE. For about twelve minutes it rests or remains in *equilibrio;* during which it is said to be HIGH WATER. It then begins to ebb, and continues to do so for about six hours, when it pauses again for about twelve minutes; during which it is said to be LOW WATER. It then begins to flow again for six hours; and so on, alternately. Hence, in every twenty-four hours and fifty minutes there are two tides.[b]

The continual flowing and ebbing of the sea, combined with the WAVES which agitate it, and the CURRENTS which run through it, keep its waters in constant motion, and thus prevent them from becoming stagnant and corrupt. But the SALTNESS of the sea, which is found to increase in warm climates *where it is most required*, contributes chiefly to preserve its waters from putrefaction.[a]

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[a] Galileo, Descartes, and particularly Kepler, made some successful approaches towards ascertaining the cause. That the tides had some connexion with the moon was natural to suppose, for they were observed always to follow her motion. The moon comes every day later to the meridian than on the preceding day, by about 50 minutes; and the tides in every part of the world happen exactly so much later every day, as the moon comes later to the meridian.

[b] If the moon were stationary, the same part of our globe would return under it every 24 hours, and there would, in consequence, be two tides every 24 hours; but while the earth is turning once upon its axis, the moon moves forward in her orbit 13°, and hence it takes the earth about 50 minutes more to bring the same meridian under or opposite to the moon.

The tides, as we have stated, are produced principally by the attraction of the moon. As the earth turns round on its axis it presents every part of its surface, in succession, to the moon, which, from the nature of attraction, exerts a greater attractive influence upon those parts of the earth's surface that are turned towards her, or *nearest*, than upon those that are turned from her, or most remote. Hence, as seas pass under the moon, the fluid particles of which they are composed, being more easily separated and attracted than particles of earth, are drawn more strongly towards her, which causes them to swell and flow, till the impulse is overcome by the attraction of the other watery particles, as they are brought by the rotation of the earth, under the more direct influence of the moon.[b]

While the water is thus attracted and heaped up on the side of the earth which is nearest to the moon, it is at the same time equally elevated on the other side of the earth or the side which is farthest from the moon; and hence there are always two tides at the same time, one on the side of the earth next to the moon, and the other on the opposite side.

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[a] If the waters of the sea became stagnant and corrupt, the earth would be rendered uninhabitable; for the atmosphere, instead of being purified, as it now is, by the perpetual agitations of the ocean, would be polluted by the exhalations arising from it, and thus unfitted for animal and vegetable life.

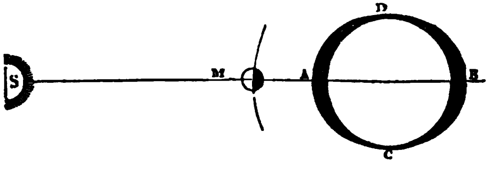
See Coleridge's Ancient Mariner, for a touching and most poetical picture of the effects produced by a long calm within the tropics. The following verse is quoted from memory :—

"The very deep did rot—alas!
That ever this should be;
And slimy things did crawl with legs
Over the slimy sea."

[b] The tide is not at its highest when directly under the moon, but in two or three hours after; and often, according to the obstructions it meets with from projecting coasts and in narrow channels, it is not high water till after the moon has passed the meridian several hours. But even where there are no interruptions, as in great oceans, it is not high water till the moon has passed the meridian two hours or so; for the waters continue to *accumulate* till the moon, by an overcoming impulse, draws them away. Compare the facts stated in note, page 31.

That the moon should attract and raise up the waters of the earth that are under her, is easy to conceive; but that the same cause should, at the same time, raise them up on the opposite side of the earth, seems strange and incredible. It is, however, perfectly true, and is easily demonstrated. The general principle is, that as those parts of the earth which are nearest to the moon are more strongly attracted towards her than the parts which are most remote, the *sea* which covers the surface of the earth on the side farthest from the moon, is less strongly attracted than the *land* which is under it, and which is consequently nearer to the moon. Hence, the body of the earth being more strongly attracted than the waters which cover its side farthest from the moon, is *drawn away* from these waters, and the same result is produced as if they had risen in tides.

The following diagram will give a clearer conception of the causes of the tides than any thing we can say on the subject. To simplify the matter, let us suppose the earth to be a regular and uniform sphere covered with water; and if there is no attraction or influence from any external body, the water will, in obedience to the laws of gravitation, arrange itself regularly and uniformly around the earth, forming a coating like the rind of an orange, and every where of the same depth. Now, let us suppose that the earth is brought under the attractive influence of an external body, like the moon, and the effects which we have already described will be produced.

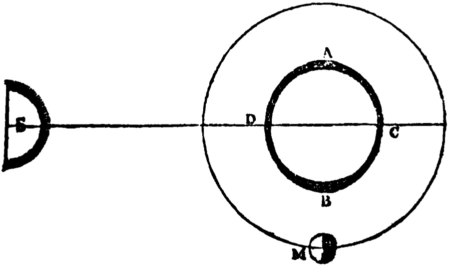


In the above diagram, A B D C is the earth, M the moon, and S the sun. At A and B the waters on the side of the earth nearest and farthest from the moon, are heaped up or elevated, and it is high water in both places. But at D and C it is low water; because the elevation of the waters at A and B causes a corresponding depression of the waters at the intermediate parts of the earth, D and C.

At the new and full moon the attraction of the sun is added to that of the moon, and the tides are in consequence *raised higher;* but when the moon is in her quarters, the attractions of the sun and moon counteract each other, that is, they act in different directions, the attraction of the one raising the waters, while that of the other has the effect of depressing them, and *lower* tides than usual are produced. The former are called SPRING, and the latter, NEAP tides.

In the preceding diagram we have *spring* tides, because the sun and the moon combine to raise the waters on the side of the earth next them, and consequently the waters on the opposite side also. And at full moon the same result will be produced, though the sun and moon are attracting different and opposites sides of the earth; for, as we have seen before, when the waters are raised or depressed on one side of the earth, they are equally raised or depressed on the opposite side.

In the following diagram, *neap* tides are represented. M is the moon in one of her quarters; and it is evident that her power to raise the waters of the earth at B is counteracted, and lessened by the attraction of the sun at D, which prevents the waters from falling so low there, and consequently from rising so high at B. At the first and third quarters of the moon, therefore, the tides are neither so high at *high* water, nor so low at *low* water as usual; while at new and full moon they are higher and lower than usual.



The influence of the moon, like that of the sun, is greater near the equator, and the tides are consequently higher in that direction, and lower towards the poles, near which they are scarcely perceptible.

In oceans and large open seas, the tides rise at regular periods, and not higher than one or two feet; as in the islands of the Pacific Ocean. But when they are interrupted in their course by coasts and headlands, or by passing through straits and channels where they often meet with opposing currents, the time at which they occur[a] is retarded, and the height to which they attain increased in proportion.

In inland seas and lakes, as in the Baltic and Mediterranean, the surface is so small,[b] comparatively speaking, that it is all equally attracted at the same time, and there is scarcely any tide perceptible. But in bays, harbours, and seas open in the direction of the great tidal currents from oceans, as in Baffin's and Hudson's Bays and the Red Sea, there are regular, and often very high tides. In the British Channel the tide sometimes rises forty or fifty feet; and in the Bay of Fundy it rises sixty, and often so rapidly that cattle feeding on the shore have been drowned before they could escape. At the mouths of large rivers opening in the direction of the tidal currents, as the Indus and Ganges, tides often rise to the height of thirty, and even forty feet, and sometimes with destructive rapidity.

CURRENTS.

The CURRENTS of the sea, which run through it in different directions, and with different degrees of rapidity, contribute to keep its waters in constant circulation. Some appear to be permanent and regular, like the great equatorial and polar currents; while others, like the causes that produce them, are subject to change and irregularity.[c]

The great EQUATORIAL CURRENT, which flows constantly from east to west, for about thirty degrees on each side of the equator, is the most regular and the most extensive current in the ocean. In the Atlantic Ocean, within the tropics, it begins to be felt near the coast of Africa. On reaching the eastern projection of South America, it divided into two branches or streams, one of which flows along the coast of Brazil, and passes into the Pacific Ocean through the Straits of Magellan; the other proceeds to the north-west, and turning into the Caribbean Sea, passes into the Gulf of Mexico through the straits formed by the western extremity of Cuba and the peninsula of Yucatan. Here, after following the bending of the coast from Vera Cruz to the mouth of the Rio del Norte, and thence to the mouths of the Mississippi, and along the western coast of Florida, it rushes with great rapidity through the Gulf or Strait of Florida, under the name of the GULF STREAM, so well known and so useful to mariners. The re-action produced by striking against the coasts of the Gulf of Mexico, the immense quantity of water added to it by the great rivers which discharge themselves into that gulf, and the narrowness of the channel by which it escapes, all conjoin to increase the velocity of the Gulf Stream. After passing through the Bahama Channel, it turns to the north-east, and flows along the coast of the United States[a] with diminishing velocity, till it strikes against the southern shores of Newfoundland. Here it changes its course to the east-south-east, about as far as the Azores,[b] where turning more and more to the south, it flows along the coasts of Europe and Africa in the direction of the Canaries, till on reaching the parallel of Cape Blanco, it completes its grand tour of the Atlantic, by mingling its waters with the great western or equatorial current, from which it originally proceeded, and with which it again sets out in the direction of America.

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[a] *Winds* also often produce irregularities in the *time* and *height* of tides.

[b] The contributing, and indeed chief causes of the almost imperceptible tides in the Mediterranean and the Baltic, are the narrowness of their entrances, and their not being turned in the direction of the main tidal currents.

[c] Such as a gale of wind; a change in the temperature, or in the saltness, between two parts of the sea, &c.

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[a] The velocity of the Gulf Stream, in issuing from the gulf, is about five miles an hour; and along the coasts of Georgia and the Carolinas, from three to two miles an hour. Its distance from the shore here is about 70 miles, but it recedes gradually from it as it proceeds northward. Its general breadth is about 60 miles, but it also increases as it moves northward. As it proceeds to a colder climate, it is easily distinguished by the beautiful blue colour of its waters, its higher temperature, and the exhalations and fogs which arise from it, particularly near Newfoundland.

[b] About the end of the fifteenth century, before the discovery of America, two bodies belonging to an unknown race of men were cast by the Gulf Stream on the coast of the Azores. This circumstance, it is said, strengthened Columbus in his belief regarding the existence of a western continent. The productions of tropical America have often been cast upon the coasts of Norway and Scotland; and in one instance the mast of a vessel burned in the West Indies was cast upon the Hebrides.

In the Pacific Ocean the great equatorial current moves with great regularity, from the western coast of America to the eastern coast of Asia and New Holland, and is of great advantage to navigators in that direction. Arriving there, it is interrupted and divided into several distinct currents, which render navigation difficult and dangerous among the numerous islands lying between New Holland and the continent of Asia. A large portion of it moves round the southern extremity of New Holland, producing the strong currents that are met with in the straits between that island and Van Diemen's Land; and coasting along, it gradually resumes its western tendency in the direction of Madagascar and the coast of Africa.

The great POLAR CURRENTS flow from each of the poles in the direction of the equator. It is owing to these currents that immense masses of ice are carried from the polar to the temperate regions, which render navigation so dangerous in the northern parts of the Atlantic Ocean, particularly in foggy weather.[a] And Captain Parry's celebrated attempt to reach the north pole by means of boat-sledges and reindeer was frustrated by the prevalence of the polar currents. He found that as they advanced over the fields of ice to the *northward*, they were actually carried at a quicker rate to the *southward*.[b]

If from the middle of a tub filled with water you take up the full of a quart, for instance, you will observe the water rushing from the sides of the tub towards the centre, till an equilibrium or level is produced. This is a familiar illustration of the causes which produce the currents of water from the poles towards the equator. The great quantity of water raised by evaporation in the equatorial regions produces a deficiency, and destroys the level of the waters in the middle part of the globe; and hence, from the colder regions, north and south, currents flow towards the equator, to supply the deficiency and to restore the equilibrium.

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[a] Immense masses of ice are sometimes met as low as the 45th and even the 40th degrees of latitude.

[b] It is owing to these currents that pine trees in great numbers are frequently cast upon the northern coast of Iceland which supply the inhabitants with much of their fuel. These pines are brought by polar currents from Siberia and North America.

This appears at variance with the description which we have given of the *western* tendency of the waters within the tropics; but the following explanation will reconcile the discrepancy. The waters, as they advance from the polar seas towards the equator, come from regions where the rotatory motion of the earth is less,[a] to those where it is greater; and before they have time to acquire the rapid velocity with which the earth moves in the equatorial regions, they are left rather behind, that is, to the *westward;* the earth turning round in the opposite direction. Hence, as the water does not move eastward along with the earth, it will *apparently* move *westward;* and this apparent motion will be kept up by the continual arrival of water, to which the increased velocity of the equatorial regions has not been communicated.

Contrary currents flowing side by side are often met; and the existence of *under* currents is extremely probable—that is, of currents flowing in one direction on the surface, while at a greater depth below them, currents flow in different and even in opposite directions. Thus, in the Cattegate, one current enters the Baltic along the coasts of Jutland, while another glides out of it by the shores of Sweden; and it is thought that the Mediterranean, into which a powerful current constantly flows through the Straits of Gibraltar, sends back, by *under* currents, a portion of its water to the Atlantic.[b]

When two opposing currents of equal force meet, particularly in narrow channels, they sometimes, by turning upon a centre, assume the form of *eddies* or *whirlpools.* It is thus the celebrated Charybdis, the terror of ancient mariners, is formed; and the modern, and far more dangerous Charybdis, the Maelstrom on the coast of Norway. The power of the latter is such, that ships and even whales have been drawn in and ingulfed from a distance of two or three miles. It roars, especially in storms, with a tremendous noise, and its influence is often felt at the distance of nine miles.

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[a] See note, page 37.

[b] In some parts of the Caribbean Sea, where the equatorial currents run strongly, it has been affirmed that a boat might be kept in a fixed position by suspending from it a heavy body at a depth sufficient to place it beyond the influence of a current on the surface. In this case it is assumed, that the immersed body would be impelled by an *under* and contrary current, in a direction opposite to that of the boat, and with equal force.

The currents of the ocean, by circulating from cold to warm regions, not only tend to equalize the temperature of its waters, but have a similar effect upon the temperature of the earth. Extreme cold would render many parts of the earth uninhabitable, but for the milder temperature of the adjoining seas.

CHAPTER IX.

THE ATMOSPHERE — ITS PROPERTIES, AND USES.

The atmosphere[a] is that transparent, elastic, and invisible fluid which encompasses the earth on all sides, to the height of about forty-five miles.[b] It revolves with the earth round its axis, and is carried with it in its orbit or course round the sun. The existence of this fluid is essential not only to animal, but also to vegetable life. Where it is very *rare*, as on the tops of lofty mountains, respiration or breathing is found to be very difficult; and it is known that if an animal be placed within the exhausted receiver of an air-pump, it will immediately die.

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[a] *Atmosphere*, that is, the *vapour* of the *sphere*. The air was formerly considered to be an elementary or simple substance; but it is now ascertained to be compounded of two distinct and very different ingredients, namely, *oxygen* and *nitrogen* gas. In every 100 parts of atmospheric air the constituent parts are, according to Dr. Murray:

	By Measure.	By Weight.
Nitrogen gas or impure air, .	77·5	75·55
Oxygen gas or pure air, . .	21·0	23·32
Aqueous vapour, . . .	1·42	1·03
Carbonic acid gas, . . .	·08	·10

[b] The *exact* height of the atmosphere cannot be determined, but above this distance from the earth, it ceases, from its great rarity, to reflect the rays of light from the sun.

Without an atmosphere there would be neither rain nor dews to refresh and fertilize the earth. It decomposes and dissipates the mephitic or infectious vapours which are continually exhaling from the earth; and it is the grand agent which, by tempering the extremes of heat and cold, renders every clime habitable to man. It is to its REFLECTING and REFRACTING powers that we owe the morning and the evening TWILIGHT, and the general diffusion of the sun's light over the whole heavens. If it were divested of these powers, instead of the gradual approach of night which prepares the world for the change, the transition from the brightness of day to the darkness of midnight would be instantaneous. And it is entirely owing to the REFLECTIVE powers of the atmosphere that the sun is enabled to light up the heavens. For if his rays were not reflected and diffused through the heavens, only that part of the sky in which he appears would be enlightened, while in every other direction, the sky would be as dark as midnight; and the stars would be visible at noonday.

REFLECTION—TWILIGHT.

In the morning, when the sun is eighteen degrees below the horizon, his rays pass over our heads into the higher regions of the atmosphere, from which they are *reflected* towards the earth. The day is then said to *dawn;* and the light continues to increase till the sun appears above the horizon. In the evening, in like manner, we have light from the sun till after he has sunk eighteen degrees below the horizon. This light, which grows fainter and fainter till it is lost in the darkness of night, is called TWILIGHT. The duration of twilight varies with the latitude of the place, the season of the year, and the height and state of the atmosphere. In the equatorial parts of the earth the twilight is at all seasons very short,[a] while in the polar regions it lasts often for several months. For as the sun during the winter, in those regions, is scarcely ever more than eighteen degrees below the horizon, the twilight, during that season, scarcely ever terminates. The inhabitants of those dreary regions, therefore, though deprived for a great part of the year of the presence of the sun, are not, as we might conclude, left in total darkness. The lengthened twilight,[a] the almost constant light of the moon,[b] and the brilliancy of the *Aurora Borealis*, particularly about the winter solstice, enable them often to pursue the ordinary occupations of the day.

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[a] In the equatorial parts of the earth, the sun descends beneath the horizon in the evening, and approaches it in the morning, in a *direct*, and therefore, *speedier* course; while in the other parts of the earth, particularly in the direction of the poles, he moves *slantingly* from and towards the horizon (in the evening and morning).

> "Even in the depth of polar night, they find
> A wondrous day; enough to light the chase,
> Or guide their daring steps to Finland fairs."

REFRACTION.

The density of the atmosphere increases in proportion to its proximity to the earth; for the nearer any portion of the atmosphere is to the earth, the more it is compressed by the parts which lie above it; just as if a quantity of wool were piled up upon a floor, those flakes which are lower would be more pressed, and therefore heavier or denser than the flakes or layers which are above them. Hence, when the rays of light enter the atmosphere, they are *refracted* or bent towards the earth, or the eye of the observer, in a curved line. From this cause all the heavenly bodies, except when in the zenith, appear higher than they really are; and in consequence of this we are enabled to see the sun for a short time[c] before he rises above, and also for a short time after he sets below the horizon. At the horizon, where refraction is always greatest,[d] it amounts to something more than half a degree (33′); from which it follows[e] that when we see the lower edge of the sun or moon apparently resting upon the horizon, its whole disc is in reality below it; and would, of course, be invisible to us but for the refraction or bending of the rays of light in their passage through the atmosphere to our eye.[a]

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[a] *Twilight*, that is, the *light between* day and night.

[b] As the moon, when at full, is in the opposite side of the heavens to the sun, she must be constantly above the horizon when the sun is below it. Hence in winter, the full moon is as high in the heavens, and as long above the horizon as the sun is in summer. And hence also at the polar circles the full moon is constantly above the horizon while passing through the northern signs.

[c] At some periods of the year, the sun appears five minutes sooner in the morning and later in the evening than he would do if there were no refraction.

[d] Because the atmosphere is most compressed, and consequently densest there.

[e] If two straight lines were drawn, one from the upper and the other from the lower edge of the sun or moon to the eye of an observer, they would contain an angle of about half a degree. In the middle of winter when the sun is nearest to us, his apparent diameter subtends an angle of 32½ minutes; and at midsummer, when he is farthest from us, it is about a minute less, that is, 31½′.

This may be illustrated by the following well-known and simple experiment. Put any small object, as a shilling or half-crown, into an empty basin as near the centre as possible, and then walk backwards till you just lose sight of the object. Let another person then pour water into the basin, and the object will again appear; and if you walk farther back till you lose sight of it again, let more water be added, and the object will again become visible. Now, if the *edge* of the basin be supposed to represent the *horizon;* the *water*, the *atmosphere;* and the *shilling*, the *moon*, it is evident that it will be seen *above* the horizon when *really* below it.

Refraction may also be familiarly illustrated by dipping the end of a staff or the blade of an oar into water. If the staff or oar is held in a slanting position, it will appear bent, and as if broken, from the part where it enters the water; but if it be held in a perpendicular position, it will appear straight as before, because there is no refraction in the direction of the zenith.

WEIGHT OF THE ATMOSPHERE.

Compared with the more solid parts of the earth the atmosphere is exceedingly light;[b] but as a whole it presses upon the earth's surface with an amazing weight. The mercury in a barometer is supported by the weight of the atmosphere, and by this instrument it appears that a column of the atmosphere of any given diameter, from its highest boundary down to the level of the sea, is equal in weight to a column of mercury of the same diameter of the height of thirty inches. It also appears (and upon this principle the common pump is constructed) that a column of the atmosphere is equal in weight to a column of water having the same base, thirty-two feet high. Hence it follows that the whole atmosphere would be equal in weight to a stratum of mercury covering the earth to the depth of thirty inches; or to an ocean of water surrounding it to the depth of thirty-two feet; or to a globe of lead sixty miles in diameter. It has also been calculated that the pressure of the atmosphere upon every square inch of the earth's surface is equal to a weight of about fifteen pounds;[a] and consequently the pressure which it exerts upon an ordinary-sized man, the surface of whose body amounts to about fifteen square feet, will be 32.505 pounds, or, in other words, upwards of fourteen tons! This pressure, which we do not even feel, would crush and destroy us were it not equal in every part, and counterbalanced by the spring or elasticity of the air within us.

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[a] On the 20th of April, 1837, the moon appeared to rise eclipsed before the sun had set, which, but for the effects of refraction, could not possibly have occurred; for the three bodies would not have been *in a line*. The same phenomenon occurred on the 20th of September, 1717.

[b] *Water* bulk for bulk has about 840 times the weight of air.

CHAPTER X.

EVAPORATION — CLOUDS — RAIN — DEW — SNOW — HAIL.

THAT process by which water is raised in *vapours* by the agency of the sun and air from seas, lakes, rivers, and moist places of the earth, is called EVAPORATION. These vapours being specifically lighter than the air which is near the earth's surface, ascend in it till they reach a stratum of their own weight, where they remain stationary. As long as they are blended and united with the air, or, as is said, are held in solution by it, they continue invisible, just as salt when dissolved in water is invisible. But when the air becomes saturated by the accession of fresh vapours, or when its dissolving power is diminished by a decrease of temperature, they are condensed, and the watery particles of which they are composed become visible, either in the form of *clouds* or *mists* floating through, or suspended in the atmosphere,—or in that of rain, hail, or snow, falling to the ground.

Though there appears to be an endless variety in the figures of the clouds, yet they are found to assume regular and systematic forms, which has led to their classification into CIRRUS, CUMULUS, and STRATUS, with their combinations, CIRRO-CUMULUS, CIRRO-STRATUS, &c. The CIRRUS clouds are those of the least density, and consequently of the greatest elevation. The term in Latin signifies curled or frizzled hair; also *fringed* or *fibrous*. The CUMULUS are those convex and conical masses which are formed in the lower regions of the atmosphere. The term in Latin means *piled* or *heaped up*. The

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[a] It has been shown by the barometer that a column of the atmosphere whose base is a square inch, weighs, when the air is heaviest, fifteen pounds.

STRATUS is a widely extended sheet of clouds often reaching to the earth. It is properly the cloud of the night. The term in Latin signifies *spread* or *extended*.

Clouds extending to, or in contact with the earth, are called *mists* or *fogs*. They are produced by a certain degree of chilness in the lower stratum of the atmosphere;[a] and in the warmer regions of the earth, they either vanish before the sun, or rise higher into the air as clouds. In cold climates, particularly in the polar regions, they are very frequent; and in some places, as off the coasts of Newfoundland, they are almost continual. This renders navigation very dangerous in those seas, particularly during the season of the ICE-BERGS.

To the vapours which fall from the atmosphere in the form of rain, hail, and snow, the earth is indebted for its springs, brooks, and rivers, which, flowing into the sea, restore to it the waters formerly drawn from it by evaporation. Hence we see that a constant circulation of waters is carried on, for the benefit of mankind, between the earth and the sky. The water that is raised by evaporation from the sea is purified in the air, and distributed over the earth by the clouds for the purpose of vegetation; and it is still further prepared for the use of men, and animals, by being impregnated with the mineral particles which it meets with in filtering through the earth before it makes its appearance again in the form of SPRINGS. Rain-water, though the purest kind of water, is from that very circumstance too insipid for drinking.

RAIN — DEW — SNOW — HAIL.

In the warm regions of the earth evaporation is most abundant; and so, as we should expect, is the quantity of rain. In the torrid zone the annual average quantity of rain has been computed to be upwards of 100 inches, while in the north temperate zone it is little more than thirty inches, that is, less than one-third. By inches of rain is meant the depth which rain falling upon a square inch of surface would acquire supposing none of it to be absorbed by the ground.[a] Hence we are enabled to form an idea of the amazing quantity of rain which falls upon the earth, and of the equally amazing amount of the evaporation which supplies it. Nor can we fail to be struck by the fact, so illustrative of the Divine agency, that the greatest quantity of rain descends upon those parts of the earth which most require it.

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[a] That is, when the lower stratum of the atmosphere is cooler than the land or the water over which it rests. The temperature of the surface of the sea in those parts of the world is greater than that of the air which is over it, because when the upper stratum of water is cooled, it descends, being heavier, and its place is supplied by warmer water from below. But the higher temperature of the waters brought by the Gulf-Stream is the chief cause of the fogs in this part of the Atlantic. See page 79.

In the following places the average annual quantity of rain has been observed as annexed:

Places.	Latitude.	Inches.	Places.	Latitude.	Inches.
Grenada (W. I.) .	12°	112	Rome, . . .	41° 54′	39
Calcutta, . .	22° 34′	81	London, . .	51° 30′	23
Charlestown (S.C.)	32° 46′	54	St. Petersburgh, .	59° 56′	16

But though the quantity of rain in the warm regions of the earth[b] is so much greater than in the cold and temperate parts of it, the number of *rainy* days is less; just as in our latitude, the mean quantity of rain which falls in summer is much greater than in winter, though the number of wet days is usually much less.

According to the *Journal de Physique*, from north latitude 12° to 43°, the mean number of rainy days is seventy-eight; from 43° to 46°, the mean number is 103; from 46° to 50°, 134; and from 50° to 60°, 161.

In the torrid zone, the temperature ranges within comparatively small limits; and the phenomena of the atmosphere occur from year to year with a regular and uniform succession unknown in this part of the world. The winds are either permanent or periodical: and the rains regularly descend at a certain season of the year, and never at any other. In fact, the only divisions of the year in those regions are the *dry* and *rainy* seasons.[c] In the northern half of the torrid zone it is the rainy season, when the sun is north of the equator; and the dry season, when the sun is south of the equator. And in the southern half of the torrid zone, the seasons, in like manner, depend upon the place of the sun. Wherever the sun is vertical or overhead, the rains and clouds are almost constant, because the atmosphere is not able to contain all the vapours which are raised by the increased heat; and thus we see that a provision has been made for protecting the earth from the perpendicular rays of the sun.

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[a] The instrument for measuring the depth of rain is called a *pluviometer* or *rain-gauge*.

[b] In the torrid zone, the rain-drops are often more than half an inch in diameter; while in these regions they seldom exceed a few lines. In fact, the rain falls in such torrents there that 16 inches have been collected in a rain-guage in the space of 24 hours (at Bombay).

[c] It is only in the temperate zones that the four seasons are known. From the sixtieth degree of latitude to the poles only two seasons take place, a long and severe winter, and a short, warm, but ineffectual summer; and within the tropics, it may be said to be perpetual summer.

The effects of these periodical rains and droughts in the tropical regions of South America[a] are thus described by Humboldt:

> "The immense plains (called *llanos*) which in the rainy season display a beautiful verdure gradually assume the aspect of a desert; the grass is reduced to powder, the earth cracks, and the alligators and the large serpents remain buried in the dried mud till the first showers o the year awaken them from their lethargy.
>
> "The rainy season begins about the end of April. The sky becomes obscured, the azure disappears, and a grey tint is spread uniformly over it; at the same time the heat progressively increases, and soon dense vapours cover the heavens from one end to the other. The plaintive cry of the howling monkies begins to be heard before the rising of the sun. The atmosphere is at length convulsed by frequent thunder storms, the rains descend in torrents, and the rivers rising rapidly above their banks overspread the plains with extensive inundations."

The suffering which the wild horses of the llanos endure on these occasions are thus described by the same author:

> "In the rainy season the horses that wander in the savannah, and have not time to reach the rising grounds of the llanos, perish by hundreds amidst the overflowings of the rivers. The mares are seen followed by their foals swimming during a part of the day to feed upon the grass, the tops of which alone wave above the waters. In this state they are pursued by the crocodiles; and it is by no means uncommon to find the prints of the teeth of these carnivorous reptiles on their thighs."[b]

In the West Indies, and in some parts of the American continent, *two* rainy seasons are distinguished; but one of them is of much shorter duration, and has much lighter rains than the other. And in some parts of the torrid zone, from the effect of mountain-ranges and peculiar winds, places under the same parallel (as the countries divided by the Ghauts in the south of Hindostan) have their dry and rainy seasons at opposite periods of the year. In some parts of the torrid zone too, as the Sahara of Africa, the plains of Peru, and the low coasts of Caraccas, rain seldom or never falls. In Egypt, too, as we have observed before, rain is almost unknown.

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[a] In the northern tropical regions of Africa showers commence in April, and increase till June, when torrents of rain begin to descend, and continue almost three months without intermission. The face of nature is soon changed; rivulets, before dried up, swell into large rivers; rivers overflow their banks; and the plains become vast lakes. In the course of September the rains cease, and not a drop falls till the following April.

[b] The horse is not originally a native of these regions. They were first introduced by the Spaniards.

Generally speaking, in all parts of the world mountains and elevated regions are more subject to rain than plains and level countries in the same latitude; and the same may be said of places near the sea, as islands and coasts, when compared with places remote from the sea (as the interior of a country) though under the same parallel. The reason is obvious; the mountains, as we observed before, intercept the clouds and bring them down in rain; and thus, they are often almost all brought down before they are carried over countries very remote from the sea; so that the nearer a place is to the sea, from which the vapours arise, the more frequently is its atmosphere saturated with them; and of course, the more likely it is to receive a large portion of them in rain.

DEW.

That moisture which in warm and dry weather, after sunset, is insensibly precipitated from the atmosphere upon the surface of the earth, is called DEW. In the warm regions of the earth, particularly in tracts of country destitute of rain, the dews are exceedingly heavy; and it need scarcely be observed that they are of the greatest use in refreshing the earth, and promoting vegetation.

It was formerly thought that dews were produced by the cooling of the atmosphere after the disappearance of the sun, which, of course, would diminish its solvent power, and cause all the vapours which it could not hold in solution to descend in moisture to the earth. But it has recently been proved that they are caused by the previous cooling of the surface of the earth, which radiates or parts with its heat much more rapidly than the surrounding air. After sunset, therefore, the surface of the ground being cooler than the atmosphere which is in contact with it, condenses and draws from it the vapours which it held in solution during the heat of the day. When a glass of cold water is brought into a warm room, particularly in summer, the outside of the glass will soon become covered with moisture, though it was perfectly dry when brought into the apartment. Now this familiar fact exemplifies the formation of dew. The outside or surface of the glass is colder, in consequence of the water which it contains, than the atmosphere of the room, and hence it condenses and forms into dew the vapoury particles with which it comes in contact. The outside of a bottle of wine brought fresh from a cold cellar into a warm dining-room will exemplify the same fact; and it is upon the same principle that moisture is formed upon the inner side of the glass in the windows of a close carriage, or of a heated room.[a]

It has been observed that in cloudy nights there is little or no dew. This is because the earth's surface on such occasions has much the same temperature as the surrounding air; for the heat that it radiates or gives out is reflected back to it again by the clouds; whereas, in clear and cloudless nights, the radiation of heat from the earth passes without obstacle to the higher regions of the atmosphere, and its surface is in consequence rapidly cooled.

It has also been observed, and the fact is worthy of our admiration, that in the same locality the deposition of dew is, generally speaking, in proportion to the necessity there is for it. It has been found, for instance, that a thermometer laid upon grass marked 16½° lower than one laid upon a gravel walk beside it; and hence we may infer that the grass in a dewy night would receive a large portion of it, while little or none would be deposited on the gravel walk. And generally, we may infer that little or no dew falls upon rocks, roads, sands, or water, even while grass and vegetables in the same locality are covered with it.

When the dew which falls upon the earth is frozen by the cold it is called HOAR-FROST. But MILDEW is not of atmospheric origin.

SNOW AND HAIL.

The other forms which the vapours of the atmosphere assume are SNOW and HAIL. When the aqueous particles or rain-drops at the moment of formation are crystalized, or frozen by the cold, they assume the form of snow; and if while falling through the atmosphere they are still further united and congealed, they assume the form of hail; for hail may be regarded as a species of snow or snowy-rain. Judging from appearances, we might conclude that the cold humidity of snow must be very detrimental to vegetation, but the contrary of this is the case. Snow, particularly in those regions where the ground is covered with it during the winter months, is of great service to vegetation by protecting corn and other vegetables from the intenser cold of the air, and especially from the cold piercing winds. It also serves to moisten gradually those lands from which, owing to their situation, the rain is soon carried off. Except in mountainous and elevated districts, snow is unknown in the warm regions of the earth; but hail has been known to fall in all parts of the earth, and at all seasons of the year, even in summer. The formation of hail seems to be owing to electrical agency; one proof of which is, that thunder and lightning are often attended with hail showers; and in fact, artificial hail can be produced by means of an electrical apparatus.

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[a] The glass, in consequence of its exposure to the external air, is colder than the atmosphere within, and hence it condenses and forms into dew the vapoury particles which come in contact with it.

CHAPTER XI.

WINDS.

The primary cause of wind is the heat of the sun, which rarefies and expands that portion of the atmosphere which, by the motion of the earth, is more immediately exposed to his rays. The air when rarefied becomes lighter, and consequently ascends to the higher regions, while the surrounding air, which is less rarefied and heavier, rushes in to supply its place. This current or motion of the air is called *wind*, and according to its velocity it is said to be a *breeze*, *gale*, *storm*, &c.

Hence it is that there are always drafts or currents of air towards a fire, or into a warm room, if the window be raised.

Winds are generally divided into three classes—*permanent*, *periodical*, and *variable*. The permanent winds extend nearly 30 degrees on each side of the equator, and blow almost always in the same direction. They are also called *trade* winds, from the great advantages which *trading* vessels derive from their steadiness and permanency. By the aid of these winds, the Spanish vessels which sail from Acapulco to the Philippine Isles, often finish a voyage nearly equal to half the circumference of the globe in 60 days, without altering their course or changing a sail.

The *higher* temperature, and the *greater* rotatory motion in the *equatorial* regions of the earth, are the causes of these great currents of air, as well as of the great currents of water which we have described in a preceding chapter as constantly flowing in a westerly direction for about 30 degrees on each side of the equator. To supply the place of the air which is constantly ascending from the torrid zone, in consequence of its rarefaction by the more direct rays of the sun, continual currents from the temperate and colder regions move in the direction of the equator. And as in the case of the currents of water from the frigid and temperate zones, these currents of air coming from regions where the rotatory motion of the earth's surface is slower, to those where it is quicker, are, before they can acquire this new velocity, left behind; and they will thus, as they do not move *eastward* along with the earth, have the appearance of moving the contrary way, that is, to the *westward*. But it is only as they approach the equator that the trade winds take a westerly direction, or in other words, blow from the eastward. Their first impulse being in the direction of the equator, they were originally north and south winds; but as they approach the torrid zone, they begin to deflect to the westward. At the northern tropic they blow from the north-east, and at the southern, from the south-east, varying a point or two of the compass either way; and as they approach the equator, they gradually blow from the eastward.

If the great equatorial band of the earth were covered with *water*, the trade winds would constantly and regularly blow in the direction here stated. But the unequal and varying temperature produced by the interposition of large tracts of land, snow-clad mountains, and heated plains of sand, diverts them from their course, and subjects them often to sudden and great irregularities. Hence it is that the trade winds are more constant and regular in the Pacific than in the Atlantic; and in the Atlantic,[a] than in the Indian Ocean.

The irregularities produced in the trade winds by the causes we have assigned, give rise to the *periodical* winds which change with the changing seasons. The most important of this class of winds are the MONSOONS,[a] which blow half of the year in one direction, and the other half, from the opposite points of the compass; and when they shift, variable winds and violent storms prevail, which render it hazardous to put to sea. These winds prevail most in the Indian Ocean, and do not extend more than 200 leagues from land.

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[a] Into the Gulf of Guinea, and along the whole coast, from Sierra Leone to the equator, southerly and south-westerly winds continually blow. The great heat and consequent rarefaction of the air over the

The monsoons, as well as the trade winds, depend on the sun: for when the sun is north of the equator—that is, from the vernal to the autumnal equinox, they blow from the south-west; and during the remaining six months of the year, while the sun is south of the equator, they blow from the north-east. When the sun is north of the equator, Arabia, Persia, Hindostan, and the Eastern Peninsula are more heated than the Indian Ocean, and the colder air from the sea consequently rushes *northward* to supply the place of the air which, in consequence of its great rarefaction, constantly ascends from these countries at this season of the year. And as this air coming from the equator has a different and opposite motion impressed upon it, the consequence is, that the compound motion of south-west will be produced. But from October to April, when the sun is south of the equator, the air above the sea being much warmer than the air above the land north of it, a north-east wind blows from these countries in the direction of the Indian Ocean.

The *land* and *sea breezes,* which are common in tropical and warm climates, are produced by the same causes, namely, the unequal and varying temperature of the land. During the day the surface of the earth becomes more heated than that of the adjoining sea; and the air above it, partaking of its higher temperature, ascends, while the air from the sea, being cooler and heavier, rushes in to supply its place. During the night the reverse of this takes place; for the air above the land suddenly cooling, while that above

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burning deserts of Africa are evidently the causes. On the coast of Peru there is constantly a breeze from the south-west.

[a] *Monsoon,* from the Malay word *moossen,* a *season.*

the sea preserves a more equable temperature, the current of air or breezes blow from the land towards the sea.[a]

The winds which are produced by the more direct influence of the sun, as in the tropical regions, are, as we have seen, either *permanent* or *periodical;* but in other countries the winds are *variable*, because they depend on a variety of causes, such as the expansion and contraction of the volume of the atmosphere by the ascent of vapour in clouds, or their descent in rain; for wherever the equilibrium in the atmosphere is destroyed, currents of air or wind will rush in that direction till it is restored. But as this equilibrium is supposed to be disturbed chiefly by electrical changes in the atmosphere, electricity[b] may be considered as the principal cause of the variableness of the winds.

There are several other winds of a local and peculiar character, such as the Sirocco, the Harmattan, the Simoom, and the Samiel. These winds are rendered pestilential by the suffocating sands of the deserts, or by the putrid exhalations of the swamps and marshes over which they pass.

The *Sirocco* occurs in the south of Europe, particularly in the south of Spain and Italy. It blows from Africa, and during its continuance, which varies from a few hours to two or three days, all nature appears to languish; vegetation withers; the beasts of the field droop; and in the human frame it produces great uneasiness and exhaustion, irritating the nerves, and checking perspiration.

The *Harmattan* blows periodically from the Sahara towards the Atlantic Ocean, producing such a dryness and heat, that vegetation withers under it; and sometimes even the skin of the negroes cracks and peels off under its influence. This wind, however, is conducive to general health, by checking the progress of some diseases, and effectually curing others.

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[a] In the West Indies, the land breeze usually begins at about 7 o'clock in the evening and blows till 8 in the morning, when the sea breeze begins, increasing till about 1 o'clock, and gradually dying away in the afternoon. Between the changes there is a period of stillness, as between the ebbing and flowing of the tides. These alternate breezes are felt very powerfully on the coast of Malabar; their effect extending to the distance of 20 leagues from the land.

Without the sea breeze the heat of many places in these climates would be insupportable.

[b] *Hurricanes*, *tornadoes*, and *typhons* are supposed to arise from sudden and violent rarefactions in the air produced by electricity.

The *Simoom* and *Samiel* are peculiar to the burning deserts of Africa and Arabia; and of all others are the most dreadful and desolating in their effects. The Samiel, which occurs in the deserts of Bagdad, not only produces instantaneous death, but so mortifies the limbs of the body, that they easily come asunder. Camels seem to have an instinctive knowledge of its approach, which they indicate by making an unusual noise; and to avoid breathing it they thrust their noses into the sand; and it is in a similar way that travellers endeavour to escape its effects, namely, by throwing themselves down with their faces close to the ground, till it passes over, which is usually in a few minutes.

The velocity of the wind varies from one, to one hundred miles an hour: at the former its motion is almost imperceptible; at the latter it throws down houses, tears up trees by the roots, and sweeps their branches through the air. But in these countries the greatest velocity of the wind is supposed never to exceed 60 miles an hour. At 10 miles an hour the wind is called a *breeze;* at 20, a *gale;* at 50, a *storm;* and a *hurricane* at 80 miles an hour.

CHAPTER XII.

DISTRIBUTION OF VEGETABLES.

VEGETABLES are adapted to every kind of climate, soil, and locality: and hence they are found in every part of the earth, from the equator to the polar regions.

Some vegetables delight in great heat, others in moderate, while others flourish best in cold. Some are confined to mountains, others to valleys, while others luxuriate in open plains. Some, again, require a moist soil and humid atmosphere, while others grow only in dry regions and arid tracts; and even on the surface of naked rocks,[a] a species of vegetation exists. In this way, nearly the whole earth is covered with vegetation, and plants are found even in the dark recesses of caverns and mines, and in the beds of rivers, lakes, and seas. In short, heat and cold, sun and shade, dry and moist, fertile lands and pathless deserts, every locality and every temperature, has its own peculiar vegetation; and in those regions where vegetables cease to grow, *lichens* and *mosses*, capable of supporting animals, and even human beings, are found amid perpetual snows.

But it is in the torrid zone that vegetables are found in the greatest vigour, variety, and beauty. There, under the rays of a tropical sun, the herbaceous plants of the temperate and frigid zones, become shrubs—and shrubs, trees; while the size and number of the trees of those regions are beyond our conception.[b]

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[a] It is in such situations the *cow-tree* is found; so called, from supplying the inhabitants of those parched regions with a rich vegetable milk. The following is Humboldt's description of it:—"On the barren flank of a rock grows a tree with coriaceous and dry leaves. Its large woody roots can scarcely penetrate into the stone. For several months in the year not a single shower moistens its foliage. Its branches appear dead and dried; but when the trunk is pierced, there flows from it a sweet and nourishing milk. It is at the rising of the sun that this vegetable fountain is most abundant. The blacks and natives are then seen hastening from all quarters, furnished with large bowls to receive the milk, which grows yellow and thickens at its surface."

[b] The following description of the vegetation on the banks of the Cassiquiare, a river which connects the Amazon with the Orinoco, is

The trees of the majestic forests there are generally above a hundred feet in height; and many, particularly some species of the palm-tree, reach to 150, and even 200 feet. The gigantic baobab, on the banks of the Senegal, and in the islands of Cape Verd, is found with a trunk 50, 60, and even 70 feet in circumference, and many of its branches are larger than our largest trees. One of the leaves of the great fan-palm, will cover eight or ten men, and two or three of them are sufficient to cover a cottage.

The torrid zone is distinguished by the delicacy, as well as by the luxuriance of its vegetable productions. The most delicate spices, as cinnamon, nutmeg, cloves, and pepper, are confined to it; and in it are found the most delicious fruits, the most odoriferous herbs, and the most brilliant and beautiful flowers.

According to Humboldt, the species of plants known when he wrote,[a] amounted to 44,000, of which 6,000 belonged to the class *cryptogamia*.[b] They are thus distributed:—

In Europe	7,000
Temperate regions of Asia	1,500
Asia, within the tropics, and islands	4,500
In Africa	3,000
Both the temperate regions of America	4,000
In America, between the tropics	13,000
New Holland, and the islands of the Pacific	5,000

He also states the proportions of plants which grow in latitudes 0°, 45°, 68°, to be as the numbers 12, 4, and 1; which shows how prolific vegetation is in the equatorial

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from Humboldt:—"The luxuriousness of the vegetation increases in a manner of which it is difficult, even for those who are accustomed to the aspect of the forests between the tropics, to form an idea. There is no longer a beach: a palisade of tufted trees forms the bank of the river. You see a canal upwards of 400 yards broad, bordered by two enormous walls, clothed with lianas and foliage. We often tried to land, but without being able to step out of the boat. Toward sunset we sailed along the bank for an hour, to discover, not an opening (since none exists), but a spot less wooded, where our Indians, by means of the hatchet and manual labour, could give space enough for a resting-place for twelve or thirteen persons."

[a] Several have been discovered since, and more remain behind; for, except in Europe, the earth has been but partially explored.

[b] *Cryptogamia,* such as have neither blossoms nor visible fructifications, as the mosses, ferns, &c.

parts of the earth, compared with the temperate and colder regions.

The utility of VEGETABLES to man is obvious. Some supply us with *food*, as the different kinds of grain, fruits,[a] and roots; others furnish us with *clothing*, as cotton, flax, and hemp. Some are valuable to us as *medicines;* and others supply us with *timber*, without which there could be neither commerce nor civilization.

Some valuable plants appear to be confined to their native soil, as the *clove* and *nutmeg* to the Spice Islands; the genuine *cinnamon* to Ceylon; and the best *tea* to China. But the seeds of the most useful plants have been carried over the earth in various ways, and propagated in soils and climates suitable to their nature.

Thus the seeds of plants and stones of fruits are carried by winds, currents, and birds, to different and often distant localities; and commercial intercourse brought the *sugar-cane* and *coffee-tree*, natives of Asia, to the West Indies. The *potato* and *Indian-corn* are natives of America.

CHAPTER XIII.

DISTRIBUTION OF ANIMALS.

THE earth, the air, the waters, and, in short, all nature appears to be full of *animated* beings. We cannot, however, take more than a hasty glance over this vast kingdom of nature.

Like vegetables, ANIMALS are adapted to different climates, soils, and localities; and hence they are found in every part of the globe inhabited by man. The most useful animals too, like the most important vegetables, are the most widely distributed. The ox, the horse, and the hog, are found from the equator to the polar circles; while the sheep, the goat, and the dog, extend over the whole habitable globe. Horses and oxen, indeed, degenerate and disappear as they approach the frigid zone, but their places are supplied by the existence of animals peculiarly adapted to those dreary regions. The uses of the *reindeer* to the Laplanders are well known, and animals of the same species abound in the Arctic regions of Asia and America. The dog too, the affectionate and faithful follower of man in every country and in every clime, becomes doubly serviceable to him in those desolate regions where the assistance of other animals is denied him. Where the horse and reindeer disappear, a hardy and sagacious species of dog, peculiar to the polar regions, supplies their place. It is on sledges drawn by dogs, that the Esquimaux and Kamtschatdales travel over their snowy plains.

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[a] The *bread-fruit* tree, the *plantain*, the *sago*, and several other kinds of *palm* trees, supply the inhabitants of the torrid zone with much of their food.

The correspondence between the covering of animals and the climate which they inhabit, is strikingly exemplified in the dog species. In the polar regions[a] they are covered with thick shaggy hair resembling wool; while in warm countries, as in Barbary, their skin is perfectly smooth and almost destitute of hair. In the same way, the thick warm wool which we see upon sheep here, changes into *hair* in the torrid zone. Even in the same country the covering of several animals changes with the changing seasons. As Dr. Paley has observed on this subject, "every dealer in hare-skins and rabbit-skins knows how much the fur is thickened by the approach of winter."

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[a] The animals of the frigid zones, generally speaking, are covered with rich fur, which not only protects them from the extreme cold of these regions, but supplies man with articles of comfort and luxury.

As it would be impossible in our limited space to give even a brief outline of the animal kingdom, we shall conclude this chapter by giving a general view of the great divisions into which animals are usually classed.

DIVISION OF ANIMALS.

There are, generally speaking, four great divisions of ANIMALS, namely, *Vertebrated*, *Molluscous*, *Articulated*, and *Radiated*.

The *first division* includes all those animals which have a *back-bone*, for such is the meaning of the term *vertebrated*.[a] It is subdivided into four classes. 1. *Mammalia*, or animals which suckle their young. 2. *Birds* of all kinds. 3 *Reptiles*, as serpents of every kind; also crocodiles, alligators, lizards, tortoises, turtles, toads, and frogs. 4. *Fishes* of every kind, except the whale species.

The *second division* includes animals which have no bones, and hence the term *molluscous*, which is from a Latin word signifying *soft*. But with few exceptions, the animals of this class are inclosed in hard shells. There are six classes in this division, but we shall mention those only which are classed according to the form of their shells, namely, *Univalves*,[b] as snails and whelks; *Bivalves*,[c] as oysters, cockles, &c.; and *Multivalves*,[d] as the common barnacle.

The *third division* consists of *Articulated*[e] animals, that is, of animals which have an articulated or *jointed* structure. This division contains four classes, namely—1. *Annelides*,[f] or those that have a *ringed* structure, as leeches, centipedes, and earth-worms. 2. *Crustacea*, or those that have their soft bodies and limbs protected by a hard coating or *crust*, which in popular language we also call shell, as lobsters, crabs, prawns, and locusts. 3. *Spiders*, which form a class by themselves. 4. *Insects*, as flies, wasps, bees, and butterflies.

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[a] *Vertebrated*—from *Verto*, to *turn*, in allusion to the *joints* of the back.

[b] *Univalve*, one valve or shell.

[c] *Bivalve*, two valves or shells.

[d] *Multivalve*, many valves or shells.

[e] From the Latin *articulus*, a little joint.

[f] From the Latin *annulus*, a ring

The *fourth division* consists of animals having an anatomical structure like an assemblage of *rays* diverging from a common point or centre, from which circumstance they are called *radiated*[a] animals. It contains five classes or subdivisions, one of which only we shall mention, namely, the *Zoöphites*[b] or animal-plants; so called because they are fixed to the ground in the form of a shrub, or branch, or leafy plant. *Corals* and *sponges* belong to this class.

CHAPTER XIV.

DISTRIBUTION OF MAN.

THE earth was made for MAN; and hence he is found in every country and in every climate,[c] from the torrid regions of Africa and America to—

> "Farthest Greenland—to the pole itself,
> Where, failing gradual, life at length goes out."

On the banks of the Senegal the human body supports a degree of heat which causes the spirit of wine to boil; in the regions of the poles it sustains a degree of cold which causes mercury to freeze.

"The HUMAN ANIMAL," Dr. Paley observes, "is the only one which is naked, and the only one which can clothe itself. This is one of the properties which render man an animal of all climates and of all seasons. He can adapt the warmth or lightness of his clothing to the temperature of his habitation."

Another quality which enables man to live in every climate is, that he has been made capable of deriving nourishment from every kind of food. Without this physical capability — or, in other words, if man were not an *omnivorous* animal — he could not occupy and have dominion over the whole earth. In the frigid zone, except in those parts which border on the temperate regions, there is neither seed-time nor harvest, nor vegetable food of any kind, and the inhabitants are consequently confined to animal food.

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[a] From the Latin *radius*, a ray. The *star-fish* is a good example of this division.

[b] *Zoöphites*, from two Greek words, signifying *animal* and *plant*.

[c] The Esquimaux of Greenland dwell as far north as the eightieth degree of latitude; while in the southern hemisphere, a wretched race of men (the Petcheres) exists on the bleak and barren shore of Terra del Fuego.

In the torrid zone, on the contrary, man lives almost entirely upon vegetable food, which is the only kind of diet suited to the climate. But it is in the temperate regions that man

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[a] It is to the sea in those regions that man is chiefly indebted for his support. Its temperature, as we have already stated (page 81), is milder than that of the land; and it teems with fish, seals, and other aquatic animals, which supply the inhabitants of those sterile regions with food, light, and fuel.

> ——" The teeming seas supply
> The food their niggard plains deny."

The great walrus or sea-horse is found in herds upon the ice; and the whale, the monarch of the ocean, makes this his chosen resort. The oil of those animals is most useful to the inhabitants of those dark and dreary regions; and their fur or skins, particularly of the bear and the seal, are most valuable for clothing, and other useful purposes.

is really an omnivorous animal. In these climates every kind of food is produced, and man partakes of it all.

Some naturalists have thought it possible to class mankind according to the diversity of their food: as *carnivorous* (flesh-eaters), *ichthyophagists* (fish-eaters), *frugivorous* (fruit and corn-eaters), &c.; but such a classification would evidently be partial in its application and erroneous in principle. The Scriptures inform us that all the inhabitants of the earth are descended from a single *pair;* and though to us no additional proof is required on this point, yet it is satisfactory to know that the investigations of physiological and anatomical science have demonstrated that, however dissimilar men may be in external appearance, habits of life, physical power, and intellectual capacities, their *interna. structure* is the same; or, in other words, that they all belong to the *same species.*

In the animal and vegetable world we find great varieties in the form, appearance, and qualities of individuals of the same species, for some of which we are utterly unable to account; and even to children of the same family this observation is often applicable.

> " There's some *peculiar* in each leaf and grain,
> Some unmark'd fibre, or some varying vein."

Can we wonder then at the great varieties that have arisen among men since the world began, scattered as they have been over every country, climate, and soil?[a]

Some naturalists have divided mankind into *three* distinct races or varieties; some into *five;* while others have augmented the number to *seven,* and even to *ten.* The colour of the skin, quality of the hair, form of the features, and shape of the skull, are the traits by which the different races of men are generally distinguished.

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[a] " The difference between the most dissimilar characters, between a philosopher and a common street porter, for example, seems to arise not so much from nature as from *habit, custom,* and *education.* When they came into the world, and for the first six or eight years of their existence, they were, perhaps, very much alike, and neither their parents nor playfellows could perceive any remarkable difference. About that age, or soon after, they come to be employed in very different occupations. The difference of talents comes then to be taken notice of, and widens by degrees, till at last the vanity of the philosopher is willing to acknowledge scarce any resemblance."—ADAM SMITH.

DIFFERENT RACES OF MEN.

1. Caucasian or European. 2. Mongolian or Asiatic. 3. Ethiopian or African. 4. Indian or Native American. 5. Malay.

The HUMAN FAMILY is usually divided into five great branches or varieties, namely, the *Caucasian* or European, the *Mongolian* or Asiatic, the *Ethiopic* or African, the *Malayan*, and the *Indian* or native American. The colour of the skin is so different in each of these races, that a good *popular* division of them, and consequently of the whole human family, would be into WHITE, YELLOW, BLACK, BROWN, and RED MEN. We shall add the chief characteristics of each race.

The CAUCASIAN RACE was so called on the supposition that they originally came from the valleys of the *Caucasus*, between the Black and Caspian Seas—a region not far distant from the cradle of mankind. This supposition is countenanced, if not confirmed, by the fact that the distinguishing features of this race are found, even at the present day, in the greatest perfection among the inhabitants of those primitive regions. The

Georgians and Circassians, for instance, afford perfect specimens of it.[a]

The *Caucasian* race is distinguished from all the rest by a natural complexion of white, tinged with red; as in infants, and in persons not exposed to the influences of the sun and air.[b] Generally speaking, the head is round, the forehead expanded, the face oval, the nose thin, straight, or slightly aquiline, the mouth small, and the chin full and rounded. The hair varies in colour from fair to black, and is generally soft, flowing, or slightly curled; and the eyes from blue to dark brown.[c]

The *Caucasian* race includes the whole European family (except the Laplanders and Finns) with their descendants in America, &c.; also the nations of Western Asia, as far as the river Oby, the Belur Tag and Himaleh Mountains, and the Ganges; and the people of northern Africa, Egypt, and Abyssinia.[d]

The MONGOLIAN RACE comprises the natives of Asia beyond the Oby, the Belur Tag and Himaleh Mountains, and the Ganges (except the inhabitants of Malacca); as the Mongolians, the Chinese, the Japanese, the people of Thibet, Boutan, and Indo-China, the inhabitants of the Arctic regions; as the Samoieds, Kamtschatdales, Finns, Laplanders, and Esquimaux. The chief characteristics of this race are, the skin yellow or olive, the head almost square, the forehead low and narrow, the face large and flat, the nose small and flat, the mouth wide, the lips thick, the chin pointed, and the cheekbones prominent. The hair is coarse, lank, black, and thin; and their eyes small, black, and rising in an oblique line from the nose to the temples.

The ETHIOPIC OR NEGRO RACE comprises all the natives of Africa to the South of the Sahara and Abyssinia; also the natives of New Holland, Van Diemen's Land, Papua or New Guinea, New Britain, Solomon Isles, New Georgia, the New Hebrides, New Caledonia, the Feejee Islands, and also various tribes in the Indian Archipelago. The chief characteristics of this race are—the skin black; the head narrow and compressed at the sides; the forehead low and retreating; the cheek-bones prominent; the nose large and flat; the lips thick, particularly the upper one; the jaws narrow and projecting; the chin small and retracted; the eyes black; and the hair black, coarse, frizzled, and woolly.

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[a] Mr. M'Culloch combats the general opinion upon this point. See his Geographical Dictionary (article EUROPE).

[b] The Caucasians are of all complexions, according to the *climate*—but white is the natural colour. Thus a native of Northern Europe is fair; of Central, less so; of Southern, swarthy; a Moor more so, an Arab olive, and a Hindoo nearly black. Such of the Hindoo women as have never been exposed to the sun, are often as fair as the inhabitants of the south of Europe.

[c] Fair and auburn hair, and blue eyes, are peculiar to the Caucasian race.

[d] The Jews, the Arabs, the Babylonians, Assyrians, Medes, Persians, Afghans, Turks, Armenians, Hindoos, &c., belong to the *Caucasian* race.

The MALAY RACE includes the natives of Malaya, Ceylon, the Asiatic Islands, New Zealand, and Polynesia. In this race the skin is brown or tawny; the form of the head intermediate between that of the European and Ethiopic races; the forehead a little arched or rounded; the nose full and broad, and thick towards the point, or what is called a bottle-nose; the upper jaw somewhat less projecting; and the features generally more prominent than in the negro; the eyes black; and the hair black, coarse, curled, and abundant.

The INDIAN or AMERICAN RACE comprises all the native American tribes, except the Esquimaux. The colour of their skin is reddish, resembling that of copper or cinnamon; the forehead is short and depressed; the eyes sunk; the face broad, without being flat; the nose rather flat, but prominent; the nostrils very open; the cheek-bones high; the beard thin and scanty; and the hair black and lank.

The Malay race approximates to the Ethiopic, and the Indian to the Mongolian.

In every period of their history, and in every part of the world, the Caucasian or European race have proved themselves superior to all the others in enterprise, energy, and courage. The inhabitants of every country and climate have felt and acknowledged their superiority, and the whole world seems destined, at no distant day, to come under their dominion. A great portion of the Old World is already subject to their sway, and the whole of the New Continent may be said to belong to them and their descendants. In the remote and multitudinous islands of the Pacific Ocean, the voices of their missionaries are heard; and their colonists are pushing their settlements over the barbarous and far distant continent of *Australasia.*

But the Caucasian or European race have distinguished themselves from the other inhabitants of the world still more by the arts of peace—continued advancement in civilization—and successful cultivation of science and literature; and, in fact, it is to these studies, and to the results produced by them, that their superiority in arms is principally due.

QUESTIONS FOR EXAMINATION.[a]

Page 7. The meaning of the term Geography? 2. How may Geography be divided? 3. What is Mathematical Geography? 4. With what other sciences is this branch of Geography connected? 5. What is Physical Geography? 6. With what other sciences is this branch of Geography connected?

Page 8.—What is Political Geography? 2. With what other sciences is this branch of Geography connected? 3. The form of the earth? 4. What is a *sphere*? 5. An *oblate* spheroid? 6. A *prolate*? 7. How would you illustrate the form of the earth? 8. How the *axis* and *diurnal* motion?

Page 9.—If the earth is a globe, why does not its surface appear *globular*? 2. How illustrate this? 3. If a person six feet high stood in the middle of an extensive plain, how far could he see the *surface* of the earth around him? 4. Why are mountains and inequalities upon the earth's surface no argument against its sphericity? 5. What would be the size of the highest mountain in the world, if represented in relative proportions upon the surface of an artificial globe 12 inches in diameter? 6. How do you show this? 7. The *practical* proof of the sphericity of the earth? 8. How illustrate what is meant by sailing round the world?

Page 10.—The first person who attempted to circumnavigate the earth? 2. The first who succeeded? 3. Can you state the arguments which led Columbus, and others long before his time, to conclude that the earth must be a *sphere*? 4. Is sailing round the world from west to east, or *vice versa*, a proof of its *sphericity*? 5. How is it shown that the earth's surface is *globular* from north to south also? 6. Can you state other and more familiar proofs of the earth's sphericity in every direction? 7. Why should the hull or body of a ship continue longer in sight than the masts?

Page 11.—Why do sailors go aloft when they are on the look-out for land, or for any distant object? 2. How show that the form of the earth must be *spherical*? 3. The nature of attraction? 4. The different kinds or modifications of attraction? 5. Without the attraction of *cohesion*, what would take place?

Page 12.—Can you repeat the lines in illustration of the preceding question? 2. How is the same principle exemplified in the rain and dew-drops? 3. Also in the *globules* of quicksilver? 4. And in the manufacture of small shot? 5. Why in a globe or spherical body is the attraction of all the parts in the direction of the centre? 6. How apply this to the original formation of the earth?

Page 13.—Under what circumstances would the earth, or any round body like it, remain self-balanced in pure space? 2. What is meant by the centre of gravity of a body? 3. Do the centre of gravity and the central or middle point in a globe or spherical body coincide? 4. The lowest part or point in a globe? 5. The meaning of the terms *up* and *down*, as applied to the earth? 6. As applied to the heavens? 7. The meaning of the term *antipodes*? 8. In what direction is every part of the earth, and every thing and every person on its surface attracted? 9. Why in the direction of the centre?

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[a] A *careful perusal* of the text will enable the pupils to give satisfactory answers to these questions.

Page 14.—How illustrate the *diurnal* motion of the earth? 2. Why is one-half of the earth always enlightened? 3. Why day and night alternately? 4. Why in the course of twenty-four hours? 5. What is meant by the term *poles*? 6. Why the *north* pole called upper?

Page 15.—How illustrate the poles by making an orange or top spin round? 2. Why do the sun and heavenly bodies *appear* to revolve from east to west in twenty-four hours? 3. How illustrate these apparent motions? 4. What are the arguments against the supposition that the sun revolves round the earth?

Page 16.—If the sun revolves round the earth every twenty-four hours, what must be the circumference of the circle he would have to describe daily? 2. How do you show this? 3. What idea can you give of the *number* of the fixed stars? 4. What, of their *distance*? 5. What the inference from these facts? 6. How much is the sun larger than the earth? 7. Is there any thing known of the magnitude of the fixed stars? 8. What are they supposed to be? 9. A *planet* appears brighter and *larger* if viewed through a telescope, is this the case with a fixed star? 10. How do you account for this?

Page 17.—The *seasons* caused by? 2. What is meant by the *orbit* of the earth? 3. The *plane* of the earth's orbit? 4. How illustrate them? 5. Are we to suppose that the *orbit* of the earth is a solid or substantial ring, or that its *plane* is a real, visible, flat surface? 6. How illustrate what has been said?

Page 18.—The *equator*? 2. Why so called? 3. Into what does it divide the globe? 4. In what direction does it run? 5. If the axis of the earth were not inclined to the plane of its orbit, what would be the consequence? 6. What is the measure of the angle made by the axis of the earth with the plane of its orbit? 7. What do you understand by the axis moving parallel to itself? 8. What is the consequence of this? 9. When the *northern* half of the axis is inclined to the sun, what is the consequence? 10. When the axis of the earth neither inclines to nor declines from the sun, what is the consequence?

Page 19.—How illustrate what has been said? 2. Can you explain the diagram in this page? 3. In what position is the earth with regard to the sun at midsummer? 4. Midwinter and the equinoxes?

Page 20.—When the sun is vertical to the tropic of Cancer, how far does he shine over the north pole? 2. Why? 3. Over what part of the earth is the sun vertical, when his rays are withdrawn from the north frigid zone? 4. When the sun is vertical ten degrees north of the equator, how far does he shine over and beyond the north pole? 5. In this position of the earth, how much of its surface round the south pole is deprived of his light? 6. Over what part of the earth is the sun vertical, when he shines from pole to pole? 7. What is meant by the *circle of illumination*? 8. Why is it a *great* circle? 9. Why does it always bisect the equator? 10. The consequence of this?

Page 21.—At what periods of the year are the *parallels* bisected by the circle of illumination? 2. Why at those periods are the days and nights equal all over the world? 3. When the sun is *north* of the equator, is there more or less than half of each of the parallels within the circle of illumination? 4. When the days are *sixteen* hours long at any place, how much of the parallel of latitude of that place is within the circle of illumination? 5. How illustrate the circle of illumination? 6. In what position would the earth be if the circle of illumination coincided with the *equator*?

Page 22.—The advantage of getting a clear idea of what is meant by the circle of illumination? 2. Can you explain how it is possible that the pole of the earth always points in the direction of the pole of the heavens, while travelling round in an orbit *one hundred and ninety millions of miles in diameter*? 3. Over what part of the earth is the sun vertical on the 21st of June? 4. On the 20th of March? 5. On the 22nd of September? 6. During the winter solstice? 7. Why are the Arctic and Antarctic circles described at the distances of 23½ degrees from the poles?

Page 23.—The arguments in proof of the earth's motion round the sun? 2. The illustrations? 3. How may the sun's apparent motion to the *eastward* be observed? 4. What progress does he appear to make every twenty-four hours? 5. When the earth is in Libra, the sun is in ——? 6. When the earth is in Scorpio, the sun is in ——?

Page 24.—The *ecliptic*? 2. Why so called? 3. How illustrate it? 4. What is an *eclipse*? 5. How illustrate the principle of an eclipse of the sun? 6. Of the moon? 7. The origin of the division of the circle into 360 degrees? 8. What is the *zodiac*? 9. The *signs* of the zodiac? 10. Can you repeat the twelve signs? 11. When is the sun in Aries? 12. When in Taurus? 13. When is the sun in Libra? 14. In what sign is the earth when the sun is in Capricorn?

Page 25.—Why are there not two eclipses every month? 2. By what argument is it proved that a body projected into pure space will continue in motion for ever, in a straight line, and with uniform velocity? 3. Can you state the argument?

Page 26.—Can you explain by a diagram the causes of the earth's annual motion?

Page 27.—Can you go through the demonstration in this and the preceding page? 2. By what combination is the *circular* motion of the earth and the other *planets* produced? 3. What other names are given to the forces of projection and attraction? 4. The meaning of the terms *centrifugal* and *centripetal*?

Page 28.—If the earth at its creation had been projected *towards* or *too near* the sun, what must have happened? 2. If *too remote* from the sun, the consequences? 3. What is an *ellipse*? 4. Why is the orbit of the earth *elliptical*?

Page 29.—The meaning of the term *Aphelion*? 2. *Perihelion*? 3. Can you go through the preceding demonstration? 4. In what part of her orbit is the earth when the *centripetal* force is greatest? 5. In what part, when it is least? 6. How is it that the *centrifugal* force prevails over it in the former case, and yields to it in the latter?

Page 30.—Does the orbit of the earth differ much from a circle?

2. Why has it been given so elliptical in the diagram? 3. The difference in length between the longer and shorter axis or diameter of the earth's orbit? 4. Why is this difference almost nothing? 5. Is the earth as near the sun in winter as it is in summer? 6. How do you explain this? 7. How do you illustrate this by the *polar* summer? 8. The warmest time of the day? 9. Why? 10. The warmest time of the year? 11. The coldest time of the night and year? 12. Why is the sun when rising — on the meridian — and setting — at the same distance from us?

Page 31.—How is the magnitude of a spherical body ascertained? 2. Meaning of the terms *diameter* and *circumference*? 3. How is the length of the circumference of the earth ascertained? 4. How, the length of the diameter?

Page 32.—The length of a degree on the earth's surface? 2. Why is the equator a *great* circle? 3. How does it divide the globe? 4. Can you explain the circles in the diagram.

Page 33.—The *latitude* of a place? 2. In what latitude is the entire northern hemisphere? 3. In what, the southern? 4. Does the latitude of a place give you its precise position? 5. What other measurement is necessary? 6. What is a *meridian*? 7. *First* meridian? 8. On what is latitude measured? 9. How many degrees in the quadrant of a circle? 10. How many miles in the quadrant of a meridian circle?

Page 34.—How is latitude measured? 2. What is meant by the *universal* meridian? 3. Parallels of latitude? 4. Why called *parallels*? 5. Why parallels of *latitude*? 6. How many usually drawn? 7. How many might be drawn?

Page 35.—What is *longitude*? 2. The first meridian? 3. All nations count *latitude* from the same place; is there the like unanimity with respect to *longitude*? 4. How is this explained? 5. On what circles is longitude measured? 6. Why is longitude reckoned on the equator? 7. Are the terms *longitude* and *latitude* properly applied to a *spherical* body? 8. Why originally applied to the earth? 9. Are they, strictly speaking, applicable to the earth? 10. Why was the *Mediterranean* Sea so called?

Page 36.—In what way are the meridians made to assist in determining the longitude? 2. The length of a degree depends upon? 3. If a circle is 360 feet in circumference, what will be the length of a degree? 4. Why? 5. The length of a degree on the earth's surface? 6. Why is a degree on the equator longer than a degree on any of the parallels? 7. Why are the degrees of longitude of unequal length? 8. Why the degrees of latitude, generally speaking, of equal length? 9. How are the degrees of latitude reduced to miles? 10. How the degrees of longitude?

Page 37.—Can you state the nature and use of the *table* referred to 2. How far is longitude counted round the globe? 3. How far is latitude? 4. The extremes of latitude, north and south? 5. If one person is 180° E. longitude, and another 180° W. longitude, and on the same parallel, how far are they from each other? 6. How do you show this? 7. Strictly speaking, are the degrees of latitude of equal length?

Page 38.—Can you describe the principle of Sir Isaac Newton's theory as to the true form of the earth? 2. Can you give the proofs and illustrations added in the note? 3. A degree of a meridian near the polar circles is how much longer than a degree of the same meridian near the equator? 4. The cause of this? 5. The consequence of this? 6. In what direction do the degrees of latitude get longer? 7. Is the difference worth taking into account practically? 8. The degrees of longitude become shorter in what direction, and in what proportion?

Page 39.—How do you show that the latitude of a place in the northern hemisphere always corresponds to the altitude of the polar star, as observed from that place? 2. In what part of the earth would we be, if the polar star were in our zenith? 3. What would its *altitude* and our *latitude* be in this case? 4. At 45° N. latitude, what is the altitude of the polar star? 5. At 53°? 6. At the equator? 7. In what part of the earth would a person be, from which if he moves, no matter in what direction, he is going *southward*?

Page 40.—How measure a degree upon the earth's surface? 2. How find the circumference and diameter of the earth? 3. How much is the equatorial diameter of the earth longer than the polar? 4. How may the latitude of a place be found by the meridian altitude of the sun?

Page 41.—Why does our zenith distance from the celestial equator give us our latitude? 2. Why does the distance between the celestial equator and the poles of the heavens correspond to the distance between the terrestrial equator and the poles of the earth? 3. In what part of the earth would we be, if the celestial equator were in our zenith? 4. Where, if it coincided with our rational horizon? 5. What would be our latitude in each of the preceding cases? 6. What would be our latitude if our zenith were 45° from the celestial equator? 7. What is DECLINATION, and to what does it correspond?

Page 42.—How may our zenith distance from the celestial equator be found? 2. What is the sun's declination on the 21st of June? 3. When is the sun's south declination greatest? 4. When has the sun no declination? 5. How may the latitude of a place be found by taking the meridian altitude of the moon, or of any fixed star, whose declination is known?

Page 43.—How is longitude found at sea? 2. Why is time *earlier* towards the *east*? 3. And why in the proportion of one hour to 15 degrees? 4. When it is 10 o'clock with us, what will be the hour with persons residing 15 degrees to the *east* of us? 5. What with persons residing 45 degrees to the *west* of us? 6. How do you show this? 7. By knowing the difference in the *time* of any two places we can determine? 8. And by knowing the difference in their *longitudes* we can determine? 9. How many meridians usually drawn upon globes and maps? 10. Why 24? 11. If a meridian is drawn through every 10 degrees, every meridian corresponds to how much time?

Page 44.—What is meant by a *chronometer*? 2. The use of it in determining the longitude? 3. If it is 12 o'clock by our watches, as regulated by the sun, and only 10 by the chronometer which gives London time, what is our distance from the first meridian, and in what direction is it from us?—or, in other words, what would be our longitude? 4. Suppose it were 4 o'clock by the chronometer when it is 2 by us, what would be our longitude?

Page 45.—Why other methods for finding the longitude resorted to?

2. In what way have the eclipses of Jupiter's satellites been made available for the purpose? 3. Can you give an instance? 4. Is this method practicable at sea? 5. Why not?

Page 46.—How is the distance between two places on a globe or map found? 2. If on the same meridian and in the same hemisphere? 2. If in different hemispheres? 4. If on the same parallel and on the same side of the first meridian? 5. If on different sides of the first meridian? 6. How are the degrees of latitude reduced to miles? 7. How the degrees of longitude? 8. Can you state the principle of the *lunar* method?

Page 47.—In what part of the earth may the degrees of longitude be multiplied by 60 to bring them to miles? 2. Why? 3. Strictly speaking, is the equator greater than a meridian circle? 4. In the latitude of Dublin how many miles in a degree of longitude? 5. How find the distance between Dublin and Manchester? 6. How find the distance between any two places on a globe or map without regard to their latitudes or longitudes? 7. The shortest distance between any two places on a globe? 8. Why, if carried to the equator, will this give the distance between them? 9. In maps on which the equator is not represented, how measure the distance between any two places? 10. Why not take the degrees at the *top* or *bottom* of the map?

Page 48.—Given the difference in time between any two places, how may the difference in their longitudes be found? 2. And *vice versa*? 3. The length of a degree of longitude at the equator? 4. At the poles? 5. In latitude 45°? 6. In latitude 53°? 7. In latitude 60°? 8. At the polar circles?

Page 49.—What causes a diversity of temperature? 2. Where and when is it greatest? 3. The meaning of the terms *zone* and *climate*? 4. How many zones? 5. Their names? 6. Why so called?

Page 50.—The boundaries of each zone? 2. The extent of each in degrees? 3. Why will not the extent in degrees give their real magnitudes? 4. Can you give an estimate of their comparative magnitudes? 5. The necessity for a further division of the earth's surface with regard to temperature? 6. What may climates be regarded as? 7. The principle upon which the division into climates is made? 8. In what part of the earth are the days and nights equal throughout the year?

Page 51.—How many climates between the equator and each of the polar circles? 2. Why 24? 3. From the polar circles to the poles the climates are reckoned not by *half hours* but by? 4. Why by *months*? 5. Why six climates between the polar circles and the poles? 6. Why is the division of the earth into climates not much regarded now? 7. Can you give an example of this? 8. The difference between the temperature of Labrador and Ireland in the same latitude? 9. The inference from this and similar facts?

Page 52.—The temperature of a place generally depends upon? 2. How is this general principle modified? 3. What are the cities mentioned as having the same mean temperature though at very different distances from the equator? 4. How do you explain this? 5. Why the northern parts of North America and Asia colder than places in the same latitude in Europe? 6. Why does a declivity towards the equator increase the temperature? 7. Can you state the facts and illustrations given in the notes?

Page 53.—Why the north of Africa and south of Europe warmer than the same latitudes in America and Asia? 2. How do periodical and prevailing winds affect climate? 3. How large tracts of water? 4. What effect has an *insular* situation upon climate?

Page 54.—What is meant by *isothermal* lines? 2. The necessity for them? 3. How is their direction generally determined? 4. In what part of the earth do they, generally speaking, coincide with the parallels of latitude? 5. Why is their course irregular in higher latitudes? 6. Why will an isothermal line of any given temperature recede farther from the equator in Europe than it will either in America or Asia? 7. And why in the *maritime* parts of Europe than in the *continental* or *elevated* regions? 8. The mean temperature of the earth at the equator? 9. And at 20° north or south of it?

Page 55.—Can you state the most important isothermal lines?

Page 56.—Can you describe the seven *vegetable* zones into which the isothermal lines specified divide the earth's surface? 2. Is it meant that the plants and vegetables here specified are confined to those particular regions? 3. Can you give a description of the several vegetable zones which you might expect to meet with in ascending a lofty mountain in the *torrid* zone?

Page 57.—What is said of Teneriffe, Mount Ararat, and Etna? 2. What is meant by the *snow-line*? 3. Generally speaking, where is it highest? 4. Where does it touch the surface? 5. Its height at the equator? 6. At 20 degrees from the equator? 7. Its height in our latitude?

Page 58.—Is the height of the snow-line in different latitudes accurately ascertained? 2. How might a person at the equator experience the cold of the frigid zones? 3. Can you explain why the snow-line is higher at 20° from the equator than it is at it? 4. Can you explain why the temperature decreases in proportion to the elevation? 5. Why do we feel warmer walking along the paved streets of a town than we should if walking through a field in the country?

Page 59.—Why should we expect the snow-line to be lower in the southern than in the northern hemisphere in equal latitudes? 2. What has Humboldt said respecting the temperatures of the two hemispheres? 3. Can you give examples of the difference of temperatures in the same latitudes? 4. How do you show by the habitations of men that the southern hemisphere is colder than the northern?

Page 60.—Can you state the three causes assigned for the difference in the temperatures of the northern and southern hemispheres? 2. Why is the sun nearly eight days in the year longer on the northern side of the equator than he is on the southern?

Page 61.—The utility of mountains? 2. How are springs, brooks, and rivers formed?

Page 62.—Can you state generally the great importance of mountains?

Page 63.—How many classes of mountains? 2. Can you give the general height of each class? 3. In which class are the highest mountains in Europe? 4. In which class the highest in Ireland?

Page 64.—The highest terrestrial elevation attained by man? 2. The highest balloon ascent? 3. The elevation of Quito? 4. Can you give the estimated length of the principal mountain chains?

Page 65.—What is meant by a *plain?* 2. Plains are either? 3. What specimens in this country of barren or uncultivated plains? 4. Where are we to expect the largest plains? 5. Can you describe the great plain which extends over the north and north-east of Europe? 6. Has it no elevations? 7. The height of the Valdai Hills? 8. Can you describe the *steppes* of Russia? 9. The *putzas* of Hungary? 10. Where are the *Pontine Marshes?* 11. The meaning of the terms *Netherlands* and *Holland?* 12. What is the extent of the great plain of Hungary?

Page 66.—The meaning of the term *desert?* 2. Are there any in Europe? 3. Why not? 4. The largest and most remarkable in the world? 5. The meaning of the term *Sahara?* 6. Can you give a general description of it? 7. The *oases?* 8. To what did the ancients compare them? 9. The dangers and difficulties in crossing the Sahara? 10. What are the *camels* called? 11. Why are travellers obliged to direct their course by the stars or by the compass?

Page 67.—Can you give an instance of the calamities which occur in crossing the Sahara? 2. Why need we not describe the *deserts* of Arabia, Syria, and Persia? 3. The extent of the Great Salt Desert in Persia? 4. Where are the deserts in Hindostan, and what is said of them? 5. The Great Desert of Asia? 6. The Shamo? 7. The extent of the desert of Gobi or Cobi? 8. Of the Shamo? 9. How does the Shamo differ from the *saharas* of Africa and Arabia?

Page 68.—Where is the great American Desert? 2. Its extent and character? 3. The *savannahs* and *prairies* are generally covered with? 4. Where are they most numerous? 5. Can you describe the great plains in America? 6. The *llanos?* 7. The *pampas?* 8. The area and mean elevation of the great *plateau* of Titicaca? 9. The elevation of the plain of Quito? 10. What description does Humboldt give of the llanos of Venezuela?

Page 69.—The origin of rivers? 2. The size and character of a river depend upon? 3. The extent of the basin of the Amazon? 4. The velocity of rivers depend upon? 5. How are *cascades* and *cataracts* formed?

Page 70.—How are rivers often carried over plains? 2. Can you give instances of this? 3. How do rivers differ with regard to their mouths? 4. The breadth of the estuary of the La Plata? 5. What produces floods periodically in some rivers? 6. Can you repeat the instances mentioned in the text? 7. The danger from floods? 8. The utility of them? 9. What does Gibbon say of the Nile?

Page 71.—Can you describe the several classes into which rivers have been divided? 2. Has the length of rivers been accurately ascertained? 3. How should these rivers be studied? 4. In what class is the largest river in Europe? 5. In which the largest in Ireland and England?

Page 72.—How are *lakes* classed? 2. Give examples of each kind. 3. The most usual class? 4. Such lakes may be considered expansions of? 5. Can you give instances? 6. How do lakes of the *fourth* class generally differ from the others?

Page 73.—Where the Natron lakes? 2. What is said of Lake Cirknitz? 3. And of Xarayes? 4. How is this accounted for? 5. The largest lake in the world? 6. Its area in square miles? 7. The area of Lake Superior? 8. Of Geneva? 9. Lough Neagh? 10. Windermere? 11. What have you to observe regarding Nicaragua?

Page 74.—The tides are caused by? 2. Can you describe them? 3. Why not two tides every twenty-four hours? 4. How much the tides later every day? 5. Why?

Page 75.—How are the waters of the sea preserved from putrefaction? 2. Can you show how the tides are produced? 3. Why is the tide not at its highest when opposite to the moon? 4. How illustrate this by the facts referred to in the note?

Page 76.—How is it that the waters on the side of the earth, *nearest* and *farthest* from the moon, are equally raised in tides at the same time? 2. The illustration? 3. Can you explain the tides by a diagram? 4. Can you show how the *spring* and *neap* tides are caused?

Page 77.—When have we *spring* and when *neap* tides? 2. Why are the tides higher towards the equator?

Page 78.—Where are the tides most regular? 2. What produces irregularities in the time and height of tides? 3. Why tides almost imperceptible in the Mediterranean and the Baltic? 4. Why regular, and often very high tides in Baffin's and Hudson's Bay, and in the Red Sea? 5. Where do tides often rise dangerously high? 6. The use of *currents* in the ocean? 7. Can you describe the great EQUATORIAL CURRENT?

Page 79.—Can you give a description of the GULF STREAM? 2. The velocity of the gulf stream? 3. How distinguished from the water round it? 4. How the gulf stream instrumental in leading to the discovery of America?

Page 80.—Can you describe the great equatorial current in the Pacific Ocean? 2. How the existence of the POLAR CURRENTS proved by the failure of Captain Parry's attempt to reach the north pole? 3. Why navigation dangerous in the northern parts of the Atlantic? 4. Can you give a familiar illustration of the causes which produce the polar currents? 5. How the inhabitants of Iceland supplied with much of their fuel?

Page 81.—Why do the polar currents, as they approach the *equatorial* parts of the earth, take a *westerly* direction? 2. What is said of CONTRARY and UNDER currents? 3. How are EDDIES and WHIRLPOOLS formed? 4. Can you describe the Maelstroom? 5. Where Charybdis? 6. The utility of currents?

Page 82.—The ATMOSPHERE? 2. Its uses? 3. Its constituent parts? 4. Can its height be exactly determined?

Page 83.—What is meant by REFLECTION and TWILIGHT? 2. How produced? 3. The duration of twilight varies with? 4. Why shortest in the equatorial parts of the earth? 5. Why longest in the polar regions?

Page 84.—When the sun's rays are withdrawn from the polar regions are the inhabitants left in total darkness? 2. What in some measure compensates for his absence? 3. Repeat the verses in illustration? 4. REFRACTION? 5. How produced? 6. Its effect and utility? 7. Its amount at the horizon? 8. At the zenith?

Page 85.—How do you prove that when we see the lower edge of the sun or moon resting upon the horizon its whole disk is in reality below it? 2. State the note in reference to this? 3. Describe the experiment in illustration? 4. How else may refraction be familiarly illustrated? 5. Weight of the atmosphere? 6. How ascertained? 7. Upon what principle is the common PUMP constructed? 8. The BAROMETER?

Page 86.—The pressure of the atmosphere upon every square inch of the earth's surface? 2. How is this shown? 3. The amount of its pressure upon the body of an ordinary sized man? 4. How are we enabled to support this enormous pressure without inconvenience? 5. EVAPORATION? 6. Why do the vapours ascend? 7. When do they become stationary? 8. When visible? 9. In what form? 10. How are the CLOUDS classified?

Page 87.—MISTS or FOGS? 2. How produced? 3. How and where do they render navigation dangerous? 4. Describe the circulation of waters that is constantly going on, for the benefit of mankind, between the sea, the sky, and the earth?

Page 88.—In what parts of the earth is rain most abundant? 2. Why should we expect this to be the case? 3. The computed annual average quantity of rain in the torrid zone? 4. In the north temperate zone? 5. What is meant by inches of rain? 6. What mark of design is there in the different quantities of rain that fall in different parts of the earth? 7. In what parts of the earth is rain most frequent, or the number of *rainy* days most? 8. How is this illustrated in the text? 9. How do you account for the regularity of the rain and other phenomena of the atmosphere in the torrid zone? 10. What is a *pluviometer* or *rain-gauge*? 11. How many inches of rain have been collected, in 24 hours, in the torrid zone? 12. In what parts of the world are the *four* seasons distinctly marked? 13. Where are there only *two* seasons? 14. Where only *one*?

Page 89.—How is the year divided in torrid and tropical regions? 2. When is it the *dry* and when the *wet* season? 3. The mark of design in this? 4. Can you give Humboldt's description of the effects of these periodical rains and droughts in those regions? 5. The sufferings of the wild horses in the rainy season? 6. Is the horse originally a native of the llanos? 7. In the northern tropical regions of Africa, when do the rains commence, and when end? 8. Describe their effects. 9. In what parts within the tropics are there two rainy seasons? 10. In what two respects do they differ from each other? 11. Have all places under the same parallel their dry and rainy seasons at the same period of the year? 12. What produces this irregularity? 13. Give examples. 14. Are there any places within the torrid zone that have no rainy season? 15. Can you explain this? 16. What is said of Egypt?

Page 90.—Generally speaking, in all parts of the world, do equal quantities of rain fall in equal latitudes? 2. What localities are most subject to rain? 3. Can you state the reason? 4. What is *dew*? 5. In what regions of the earth, and in what tracts of country in particular, are the dews heaviest? 6. The utility of dew? 7. Can you state what was the opinion formerly regarding the formation of dew? 8. What is the present theory? 9. What are the illustrations given in the text?

Page 91.—Should we expect more dew in a cloudy, than in a clear night? 2. Why little or no dew in cloudy nights? 3. Is dew equally distributed over the same localities? 4. How has this been proved? 5. The general inference from this? 6. How is *hoar*-frost produced? 7. Is *mildew* of atmospheric origin? 8. What other forms do the vapours of the atmosphere assume? 9. How is *snow* produced? 10. And how *hail*? 11. If we judge from appearances, what would we conclude regarding the utility of snow? 12. In what two respects is snow stated to be of great use? 13. What is the difference between snow and hail, as to the part of the earth, and seasons of the year in which they fall? 14. How is hail supposed to be produced?

Page 92.—The primary cause of wind? 2. The illustrations given? 3. How winds divided? 4. Trade-winds—why so called? 5. An instance of their utility to navigation?

Page 93.—Can you explain the cause of the trade-winds? 2. In what case would the trade-winds blow regularly and constantly in the direction here stated?

Page 94.—*Periodical winds*? 2. The *monsoons*? 3. Why so called? 4. Can you explain the cause of the monsoons? 5. When do they blow from the *south-west*? 6. When from the north-west? 7. Why along the Gulf of Guinea, southerly and south-westerly winds constantly? 8. Why also on the coast of Peru? 9. Can you explain the *land* and *sea-breezes*?

Page 95.—Where the winds, either *permanent* or *periodical*? 2. Where *variable*; and why? 3. What may be considered as the principal cause of the variableness of the winds? 4. The velocity of the winds? 5. The probabl cause of *hurricanes, tornadoes*, and *typhons*? 6. What are the winds which are stated to be of a local and peculiar character? 7. When does the *sirocco* occur? 8. How long does it continue? 9. Describe its effects. 10. Where and when does the *harmattan* blow? 11. Its effects upon the health of the natives?

Page 96.—The *simoom* and *samiel* are peculiar to? 2. The effects of the samiel? 3. How do camels and travellers endeavour to avoid it? 4. The velocity of the wind varies from? 5. Its supposed greatest velocity in these countries?

Page 97.—How is it that *vegetables* are distributed over almost the whole earth? 2. Where found in the greatest vigour, variety, and beauty? 3. The *cow*-tree?

Page 98.—The *baobab*? 2. How show that the torrid zone is distinguished by the delicacy as well as by the luxuriance of its vegetable productions? 3. How many species of plants known to exist? 4. The proportions of plants, according to Humboldt, which grow in latitudes 0°, 45°, and 60°, are as the numbers? 5. The utility of vegetables? 6. How have they been propagated over the earth?

Page 99.—How is it that *animals* are found in every part of the globe inhabited by man? 2. What kind of animals are the most widely distributed?

Page 100.—How exemplify the correspondence between the covering of animals and the climate? 2. Dr. Paley's observation? 3. Give a general account of the division of animals; and the distribution and different races of MEN?

METHOD OF TEACHING GEOGRAPHY.

The following ARTICLE is taken from the OUTLINE drawn up by the Author for the use of the Teachers in training in the Normal School of the Commissioners of National Education. It, of course, contains his ideas upon a most important part of Geography—THE METHOD OF TEACHING IT. It also contains a great number of important facts connected with Geography, and a general view of the whole subject.]

No treatise on geography has, as yet, been published by the Board. There is, however, a series of lessons on this interesting and useful branch of education in their several reading-books, from which the leading facts and general outlines of geography may be taught. The excellent MAPS, too, published by the Board, have done more to *popularize* the study of geography in Ireland than any treatise yet given to the public. These maps are in all our schools, and in hundreds of others: and as Dr. Watts has observed in his work "On the Improvement of the Mind"—"The situation of the several parts of the earth is better learned by one day's conversing with a *map*, than by merely reading the description of their situation a hundred times over in books of geography." A connected and systematic knowledge of geography, however, requires a regular text-book on the subject: and it may be well to state here, that such a work is in preparation for the use of the National Schools. In the meantime, geography is taught in the National model and training schools, by the maps, reading-lessons, and lectures.

Before commencing geography, the pupils should be made acquainted with at least the four cardinal or principal points of the heavens. This may be done in a few minutes. Take them out at *twelve o'clock*, and tell them that if they look towards the sun, their *faces* will be in the direction of the *south*, their *backs* towards the *north*, their *right* sides to the *west*, and their *left* towards the *east;* and that this is the case *every day in the year at twelve o'clock*. Or, as children are liable to forget *which* of their sides in such a position is turned to the *east* or *west*, let them connect these points with the part of the heavens in which the sun *rises* or *sets;*[a] and they will feel no difficulty in pointing to the *east* and *west* points of the heavens or horizon.

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[a] **During the *equinoxes* only, the sun *rises* and *sets* in the *east* and *west* points of the horizon. Between the vernal and autumnal equinoxes, the sun rises and sets *northward* of the *east* and *west* points of the horizon; and between the autumnal and vernal equinoxes proportionally *southward*.**

Having fixed these points in their minds, let them return to the school-room, and *begin their first lesson on geography with it.* In which side or wall of the room is the principal entrance? may be asked; and the answer will be, in the *south.* Why? Because it is in the direction of the sun at twelve o'clock. In which side is the rostrum, or master's desk? In the *north.* Why? Because that is *the side opposite to the south.* The *east* and *west* sides of the room will be as easily pointed out; and from the school-room the question may be extended to the play-ground, and to the entire premises. The pupils will readily name the streets that run along or enclose the Education Grounds, on the *south, north, east,* and *west.* These streets they should be told, are the northern, southern, eastern, and western *boundaries* of the premises. The question may then be extended to the city generally; as, on which side of the city is Merrion or Mountjoy-square? Which side of these squares is nearest or farthest from us? In what direction is Sackville-street from Marlborough-street? Do they cross at right angles, incline, or run parallel to each other? In what direction from Dublin does Kingstown, Lucan, or Ashbourne lie? Similar questions should be put regarding the *counties* bordering upon Dublin; and thus geography is commenced, as it should be, with TOPOGRAPHY.

The pupils should then be directed to draw a ground-plan of the school-room on their slates. The dimensions should be stated to them,—or, which is preferable, they should be made to measure it themselves. As it is eighty feet in length, by fifty in breadth, they will see the necessity for reducing its dimensions, or for drawing it *on a small scale.* If the scale be *an inch* for every *ten feet,* the drawing will be *eight inches* by *five.* If reduced to a smaller scale, the drawing will, of course, be smaller in proportion. If the plan is to be on an inch for ten feet, let a line an *inch* long be drawn in a corner of it, for the *scale* by which the dimensions of the desks, &c. are to be measured and laid down. The desks, which are sixteen in number, and about thirty feet long each, may be represented by parallel lines, three inches long, and one-tenth of an inch broad; and the platform on which the master's rostrum stands, by a parallelogram, two inches by one and a half inch; and in its proper position in the school-room.

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This is a rude representation of the school-room, *as it would appear to a person looking down from the ceiling*—or, in other words, it is a *map* of the school-room. The pupils may now be introduced to a map of the world, and they will readily conceive that it is intended to represent the earth, *as it would appear to the eye of a spectator raised at an immense distance* *above it*. But as children naturally fall into the mistake of considering the eastern and western hemispheres, as *plane* and *unconnected* surfaces, they should be told that they are intended to represent a *globe*, divided into two equal parts, and placed beside each other on a flat surface, or, as the term *hemisphere* denotes, *half* globes. A familiar idea of this may be given to them by dividing an orange, or an apple, into two equal parts, and by placing them on a table, or any flat surface, with their edges in contact. Or the children may be told to conceive the two *hemispheres* to be compressed or flattened, so as to coincide with the plane; or, let them suppose them to be placed with their backs in contact, and inflated, so as to form an *entire sphere* or globe. Having formed a correct and clear idea of the map of the world, they will easily conceive that the map of Europe, Ireland, or of any particular country, is intended to represent a portion cut, as it were, out of the general map of the world. A small wooden globe, divided into two equal parts, is used in our schools, to give children correct ideas, both of the form of the earth, and of the two hemispheres, or map of the world. When the teacher is explaining the form of the *earth*, he holds the small globe in his hand; and when, the *two hemispheres* into which it is supposed to be divided, he takes it asunder, and places the *two half globes* against the wall, with their edges in contact, and in *juxta-position with a map of the world.*

Latitude, *Longitude*, the *great* and *small* circles of the sphere, *meridians*, *parallels*, and *zones*, which, to children, appear as so many mysteries, may be simply and clearly taught by the use of such a globe. The circle formed by the junction of the two halves, when united, may be regarded as the *first meridian*, and, if a circle equidistant from the poles be traced, it will intersect it at right angles, and represent the *equator*. The *tropics*, *polar*, and other circles may be easily added and explained; and if the globe be painted black, it will be easy to give an outline in chalk of the relative position and extent of the great division of the earth's surface into continents and oceans. For example, ask the pupil to point to the spot where England should be, and *if he recollects* its latitude and longitude, he will at once determine its proper position. He will say, that as it lies between the parallels of 50° and 56° north latitude, it is more than half way between the equator and north pole; and, of course, under the *first meridian*, which passes through the east of it. The position of Ireland and Scotland—the one to the *west*, the other to the *north*, of England, and forming a portion of it—may then be pointed to, or dotted in chalk; and so of other countries. In short, such a globe has, besides its *peculiar* advantages, all the utility of a *blank* or *outline map*.

The cause of day and night, and the changes of the seasons, may also be simply and clearly explained by means of two little wooden globes, such as are used in this establishment. For explaining the seasons we use a simple contrivance, which shows, at one view, the different positions of the earth with regard to the sun during the summer and winter *solstices*, and also the *equinoxes*. It consists of four small balls, painted and fixed, as represented in the diagram, page 19, and a larger ball in the centre (where the candle is supposed to be), which represents the sun. The central ball stands upon a frame like a candlestick (upon the top of which it may be made to turn as on a pivot), and supports the others by four straight wires, which issue from its centre at right angles to each other. These wires enter the small globes at the *equinoctial* and *solsticial* points; and as they represent the perpendicular rays of light from the sun at those seasons, they form the centre of the *circle of illumination;* which is represented by painting the half of each of the small globes, from this point, *white*.

The different phases of the moon may also be familiarly explained by means of small globes similarly painted; and the planetary system generally. This we do; and it is found a much easier, and, therefore, a much better way of explaining them, than by means of an orrery, which is not only a complicated, but an incorrect[a] representation of the motions, magnitudes, and distances of the heavenly bodies. The simpler the contrivance, the better for illustration, and the nearer the resemblance to the simple but sublime machinery of nature—to the works of that Great Being, who

> "Bids seed time, harvest, equal course maintain,
> Through reconciled extremes of drought and rain;
> Builds life on death, on change duration founds;
> And makes the eternal wheels to know their rounds."

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[a] "Choose any well-levelled field or bowling-green; on it place a globe two feet in diameter: this will represent the sun; Mercury will be represented by a grain of mustard-seed on the circumference of a circle, 164 feet in diameter, for its orbit; Venus, a pea, on a circle of 284 feet in diameter; the earth, also a pea, on a circle of 430 feet; Mars, a rather large pin's head, on a circle of 654 feet; Vesta, Juno, Ceres, Pallas, grains of sand, in orbits of from 1,000 to 1,200 feet; Jupiter, a moderately-sized orange, in a circle nearly half a mile across; Saturn, a small orange, on a circle of four-fifths of a mile; and Uranus, a full-sized cherry, or small plum, upon the circumference of a circle more than a mile and a half in diameter. As to getting correct notions on this subject by drawing circles on paper, or still worse, from those very childish toys called orreries, it is out of the question."—*Sir J. Herschel's Astronomy.*

Having taught the pupils as much of *Mathematical* Geography it will enable them to comprehend the figure, magnitude, and motions of the earth, their attention is directed to the great divisions into which its surface is naturally divided; or, in other words, they are introduced to *Physical* Geography.

We begin by giving them general views and leading ideas. Having made them observe that there is far more *water* than *land* upon the surface of the globe, we inform them that the proportion is probably as seven to three; or, in other words, that more than two-thirds of the earth's surface are covered with water.

We then inform them, that the entire surface of the earth, land and water included, is supposed to contain about one hundred and fifty millions of *geographical* square miles;[a] and they will draw the conclusion, that the extent of the land must be less than fifty millions, or less than one-third. Having supposed that the land on the earth's surface contains about forty-five millions of geographical square miles, we distribute it into five great divisions or continents, namely, Asia, America, Africa, Europe, and Oceanica; observing at the same time, that the *water* is also divided into five great divisions or oceans, namely, the Pacific, the Atlantic, the Indian, the Northern, and the Southern oceans. After learning from a map of the world, the relative position and comparative extent of the great divisions of land and water into continents and oceans, they may be told that Asia is supposed to contain *rather more than one-third* of the land on the earth's surface; America *nearly one-third;* Africa, *about one-fifth;* and Europe and Oceanica, *about one-fifteenth* each. Then comes the question—how many millions of geographical square miles in Asia? About fifteen; because Asia contains about the one-third of the land on the surface of the globe, which is supposed to amount to forty-five millions. Similar questions may be put regarding the other great divisions; and the answers will be—America contains nearly fifteen millions; Africa, about nine; Europe and Oceanica, about three each; because these divisions respectively constitute *a third, a fifth,* and *a fifteenth* of the whole land on the surface of the globe, that is, of forty-five millions of geographical square miles. Again, how much is Asia larger than Europe? *Five times as large;* for Asia contains about fifteen millions of geographical square miles, and Europe only about three millions. How much is Africa larger than Europe or Oceanica? *Three* times as large; for Africa contains about nine millions, (*one-fifth of*

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[a] The superficies of a globe is found by multiplying the circumference by the diameter.

forty-five,) and Europe and Oceanica, only three each. Are any of the great divisions nearly equal in point of extent? Yes; America is nearly equal to Asia; and Europe to Oceanica.

These proportions are not only pleasing to the pupils, but are calculated to give them clear ideas of the comparative extent of land and water on the earth's surface; and of the real and relative size of each of the great continents into which it is divided. Similar proportions may be discovered, and similar questions put respecting the several countries constituting the continents. For instance, if a pupil is informed that about one-third of Asia belongs, or is tributary to China, and nearly another third to Russia, he will at once conclude that each of these powers possesses a territory equal to about five millions of geographical square miles; and that all the other countries taken together, constitute the remaining third of Asia. This is a great and leading idea of Asia, and will be easily recollected. Again, of the remaining third of Asia, Arabia constitutes about the *one-fifth*, and Hindostan something more than *another fifth*. Arabia and Hindostan, therefore, contain each about one million of geographical square miles. They have also each of them, the same proportion to the continent of Asia, that Europe has to the entire land upon the earth's surface, namely as 1 to 15. With regard to the other countries a similar process is pursued.

General views with regard to the population of the world are, in like manner, given to the pupils. For instance, the population of the world is supposed to amount to about 800 millions, which, if divided by 45,000,000, the number of geographical square miles contained in the earth's surface, gives about 18 persons to the square mile. The population of Asia amounts to about 390 millions; of Europe, to about 240; of Africa, to about 70; of America, to about 42; and of Oceanica, to about 20,300,000. Asia, therefore, contains about *one-half*, and Europe nearly *one-third* of the population of the world. The absolute population of Asia is greater than that of Europe, but its relative is far less. For, divide the amount of the population of each by the number of square miles contained in the surface, and the quotient will give 80 persons to the square mile for Europe, and only 26 for Asia. In the same way we proceed with regard to the other continents and countries.

The great *physical* features and natural boundaries of the several continents are next pointed out. For instance, South America is, generally speaking, divided by mountains and rivers into five great divisions—namely, the western declivity between the Andes and Pacific Ocean; the basin of the Orinoco; the basin of the Amazon; the basin of the Paraguay:

and the southern extremity. In like manner, North America is divided into five great natural divisions—namely, the basin of the Mississippi; the western declivity between the Rocky Mountains and the Pacific Ocean; the northern declivity between the Great Lakes and the Arctic Ocean; the eastern declivity, between the Alleghany Mountains and the Atlantic; and the basin of the St. Lawrence. Again, Europe may be traversed from S.W. to N.E. without crossing any considerable river. Europe is, therefore, divided by mountains and elevated regions into two grand declivities, namely, the north-western and the south-eastern; and the great rivers, generally speaking, will consequently flow in a N.W. or S.E. direction. The Volga, the Dnieper, the Don, the Danube, &c., flow in the latter, and the Rhine, the Elbe, the Vistula, the Oder, &c., in the former direction. Of course there are other declivities, and consequently rivers in other directions, but we are speaking generally.

The physical features and natural divisions of Asia are peculiarly grand and striking. In the centre is the great table-land or elevated regions between the Altai Mountains on the north, and the stupendous range of the Himalehs on the south. Between this elevated region and the Arctic Ocean, is the great *northern* declivity, which extends from the Uralian Mountains on the west, to the rocky shores of the Pacific on the east. The great *southern* or *south-western* declivity of Asia comprehends all the countries southward of the Himaleh Mountains, the Caucasian, and the intermediate chains—that is, generally speaking, the Eastern and Western Peninsula, Persia, Arabia, and Syria. The great *eastern* declivity comprehends China, Corea, and the eastern part of Chinese Tartary. The *western* declivity, which is much less extensive than the others, lies to the west of the Belur Tag, and the chain of mountains which connects the Himaleh with the Altaian ranges. These grand natural divisions may be traced by the great mountain ranges which separate them, and the immense rivers which flow through them. For instance, the *northern* declivity is shown by the course of the Lena, the Yenessei, and the Obi; the *eastern*, by the Amour, the Hoang-ho, and the Yang-tse-kiang; and the *southern*, by the Euphrates, Tigris, Indus, Ganges, Irrawaddy, and Cambodia; and the *western*, by the Sihon or Jaxartes, and the Oxus or Jihon. A knowledge of the great mountain ranges is of far greater utility to pupils in geography than is generally thought. Upon their height, direction, and distance from the sea, depend, generally speaking, the magnitude and directions of the rivers. If near the sea, the rivers which flow from them are short, rapid, and ill-adapted for navigation. Such rivers we may expect to find between the Andes and the Pacific Ocean. If at a great distance from the sea, the rivers which flow from them, will be long, gentle, and navigable. Upon such rivers man takes up his abode—towns are built—commerce commences—and civilization follows in its train.

When the pupils are made acquainted with the general outlines and natural divisions of the earth's surface, we proceed to *Political Geography*. In this branch of geography, also, we begin by giving general views and leading ideas; and having traced the great outlines, we fill them up gradually, and in every thing that concerns Great Britain and Ireland, as minutely as practicable. At every step we apply the principles of CLASSIFICATION and COMPARISON.[a] Mountains, rivers, lakes, states, cities, &c., are *classed* and *compared;* which not only assists the memory of the pupils, but enables them to form correct conceptions of the real and relative magnitude of each. They are told, for instance, the height of a mountain, or the length of a river, with which they are familiar—or the population of the town in which they reside, and from these points the *classifications* and *comparisons* commence. The pupils are thus enabled to form correct and clear ideas of things which they do not know, by comparing them with things with which they are familiar. The largest river in Ireland is the Shannon—the largest in Europe the Danube (for the Volga is rather an Asiatic river); the length of the former is scarce 200 miles, of the latter about 1,800. It would take nine such rivers, therefore, as the Shannon, to make the Danube. Again, the highest mountains in Ireland are the Reeks in Kerry—in Europe, the Alps; the highest of the former (*Carn Tual*) is 3,410 feet above the level of the sea; of the latter (*Mont Blanc*), 15,668. The Alps are, therefore, nearly five times as high as the highest mountains in Ireland. Or, four such mountains as Carn Tual, piled on the top of each other, would not equal Mont Blanc in height and magnitude. What an idea this gives to children of the surpassing grandeur of Mont Blanc—"the Monarch of Mountains!" And how their conceptions are enlarged, when informed that there are mountains in America and Asia nearly twice as high!

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[a] This great improvement in the method of teaching geography (by CLASSIFICATION and COMPARISON) is principally due to Mr. Woodbridge, the eminent American geographer. The other great improvement—namely, *beginning with the school-room,* and leading the pupils gradually, *du connu a l'inconnu,* (from the known to the unknown,) may be traced to Pestalozzi.

INTRODUCTION TO ASTRONOMY.

TEACHERS should prepare their pupils for the study of astronomy by directing their attention to the apparent motions and relative positions of the heavenly bodies. For this purpose let them be conducted to some place in the neighbourhood which commands an uninterrupted view of the horizon. Looking around them, they will observe that they appear to be in the middle of an immense circle, the circumference of which is formed by the apparent meeting of the earth and sky. The circumference of this imaginary circle, it may be observed, is called the HORIZON, because it *bounds* or limits the view of the observer.

They will observe also that the heavens present the appearance of a vast concave hemisphere, every part of which seems equally distant from them; or, in other words, in the centre of which they appear to stand.

During the day the magnificent dome of the heavens is lighted up by the sun, which, after rising above the eastern horizon, and traversing the sky in a circular course, disappears in the west. When the sun sinks beneath our horizon, the stars, which seem to be scattered in thousands over the vault of heaven, begin to make their appearance; and the moon, at her appointed time, hangs out her silvery lamp, as if in aid of their too distant light.

On the following morning the sun re-appears in the east, and after going over the same course as on the preceding day, he disappears again in the west. The daily repetition of this magnificent phenomenon has made it so familiar to our eyes, that we, perhaps, cease to regard it with wonder and admiration; but to the young and inquiring mind such questions naturally suggest themselves—is it the same brilliant body that traverses the heavens day after day, dispensing light and heat to the earth which we inhabit? Or is there a new sun every day? If it is the same sun as it appears to be, what becomes of it during the night? Or how is it that, after disappearing from our view in the evening, in the west, it re-appears the following morning in the opposite point of the heavens? Does it continue its *circular* course *under* the earth during the night, and thus, *by completing the circle*, return to the point from which it set out in the morning? If so, the earth is not, as it appears to be, a vast plain or flat surface extending to the heavens. It must be separate or *detached* from the heavens (at least on the eastern and western sides), otherwise the sun and the stars—for it will be found that they have a similar motion—could not revolve round it in this way.

Such observations and such inferences young and inquiring minds will naturally make; and it will be the part of the instructor to lead his pupils to make such observations, and to assist them in coming to correct conclusions.[a] It was in this way that astronomy was originally studied, long before globes were invented or books written, and it is in this way the first and great principles of the science should still be taught. Let the teacher, therefore, conduct his pupils step by step over the ground which the first discoverers trod; and the difficulties of astronomy, which to young and uninstructed minds seem so numerous and so formidable, will gradually disappear—nay more, these very difficulties will be converted into subjects of admiration and delight.

Let us now take a view of the starry heavens. The stars appear to be innumerable, and they are so in reality, though to the naked eye there are scarcely ever so many as two thousand visible, even in the brightest nights. At first view they appear to be fixed in the heavens, but if after short intervals we repeat our observations, we shall find that, like the sun, they have a regular motion from east to west. For if, having observed any particular star to be in a line with our eye, or some lofty object, such as a tree or the top of a chimney, we repeat our observation in, say an hour after, we shall find that this star, and the others which we may have noticed in the vicinity of it, have moved a considerable space to the westward. The stars, too, which we observe near the western horizon will in a short time disappear beneath it; whilst others, not now visible, will soon make their appearance in the east. But while the stars in general appear, like the sun, to rise in the east and set in the west, there are others which appear to revolve round a fixed point in the heavens, without ever reaching so far as our horizon. This point is called the POLE of the heavens, because the whole celestial sphere appears to *turn* round it as on a pivot, from east to west, in twenty-four hours, carrying with it in the same direction, and in the same time, the sun, moon, and stars.

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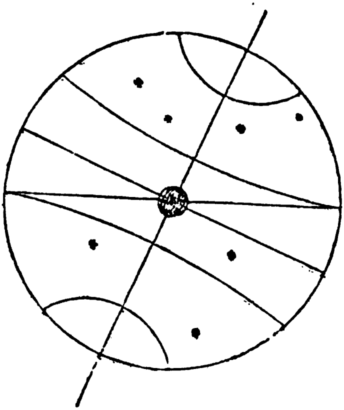
[a] For example, having of themselves come to the conclusion that the earth must be detached from the heavens on the *east* and *west* sides, they may be led to infer by *analogy* that it is detached from the heavens on every side, or all round the horizon. The importance of this fact is obvious; for if the earth is detached from the heavens on every side, it must be self-supported.

The apparent diurnal motion of the heavens may be illustrated in the following simple manner:—Through a small glass globe, such as those out of which watch glasses are cut, pass a knitting-needle from the circular aperture at the bottom[a] to the point opposite, and make the globe turn round upon it as upon an axis. The globe will represent the celes-



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[a] The aperture at the shank or pipe through which the globe was blown.

tial sphere, and the knitting-needle the axis on which it is supposed to turn. Before introducing the imaginary axis, affix to its middle point a small ball about the size of a marble, to represent the earth in the centre of the celestial sphere. The points of the globe at which the needle, or, as we shall now call it, the axis, enters and terminates, will represent the poles of the heavens; and to complete the illustration, the sun and a few of the principal stars may be represented by bright specks of paint or gold leaf on the convex or outer surface of the globe.

Now let the teacher, having inclined the upper or north pole of the glass globe in the direction of the pole star, make it turn round upon its axis from east to west, and his pupils will have a clear and correct representation of the apparent motions of the heavenly bodies—that is, if they conceive themselves to be on a fixed point on the surface of the small globe in the centre, which represents the earth.

To aid their conception, a circle should be drawn round the glass globe to represent the celestial equator, and another and corresponding one round the small globe in the centre to represent the terrestrial equator. A meridian circle or two should also be drawn on each of the globes.

Now, from the point on which we conceive ourselves to be placed, it will be easy to conceive that only one-half of the concave surface of the outer globe can be seen, as in the case of the visible heavens. The circle which divides the *visible* half of the sphere from the half which is *invisible*, is called the RATIONAL HORIZON; and the highest point of the visible hemisphere, or the point directly over the head of the observer, is called the ZENITH. The zenith is evidently a *quarter* of a circle, or 90 degrees, distant from every point of the horizon; and if we conceive a straight line drawn from the zenith through the earth, in the direction of our feet, it would point to the NADIR, or the lowest point of the invisible hemisphere of the heavens.

The relations which exist between the circles supposed to be drawn on the terrestrial and celestial spheres should also be pointed out. The equator of the earth, if extended to the heavens, would coincide with the celestial equator; and the same may be said of the corresponding meridians. Between the terrestrial and celestial tropics, polar, and the other corresponding parallel circles, similar relations exist;

and it is evident from the ILLUSTRATION in our hands, that the axis of the heavens is a continuation of the axis of the earth.

It may now be shown that the horizon, and consequently the aspect of the heavens, varies with the position of the observer. If we were at the north pole of the earth, for instance, it is evident that the polar star, or north pole of the heavens, would be in our zenith,[a] and that our rational horizon would coincide with the celestial equator. In such a position all the northern celestial hemisphere would be visible to us, and all the heavenly bodies situated in it would appear to move round and round in circles parallel to the horizon. Those that are in the equator will sweep the horizon, and those that are near the pole star will make small circles round it; while the stars in the southern hemisphere will remain constantly invisible to us. This is called the PARALLEL position of the sphere. Now let us suppose ourselves transported to the equator, and it is evident that the celestial equator would be in our zenith, and the poles of the heavens in our rational horizon. In such a position, the stars would appear to us to rise and set at right angles to the horizon; and as the half of each of the diurnal circles which they describe is *above*, and the other half *below* the horizon, it follows that they must be visible and invisible alternately for *half* the time of their diurnal rotation, that is, for twelve hours. Those that rise in the east point of the horizon will, after traversing the heavens in a semicircle passing through the zenith,[b] set in the west; while those that rise between the east and the south points of the horizon, or between the east and the north, will, after describing regular semicircles, set in the corresponding points of the horizon in the opposite side of the heavens.

This is called a RIGHT position of the sphere, because the equator, and all the circles parallel to it, cut the horizon at *right* angles.

Now let us in supposition move *northward* from the equator, and it is easy to conceive that the polar star, or north pole of the heavens, will appear to rise above the northern point of the horizon in proportion to the space passed over; and that the south pole of the heavens will sink beneath the southern point of the horizon in the same proportion. If, for instance, we travel ten degrees *north* from the equator, the pole star will appear to us to be elevated the same number of degrees above the northern point of the horizon, while the south pole of the heavens will be depressed beneath the southern point of the horizon in the same proportion; and if we travel a like distance *south* of the equator, it is easy to conceive that the reverse of this would take place.

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[a] Accurately speaking, the polar star is 1° 20′ from the pole of the heavens; it is, therefore, never exactly over the pole of the earth.

[b] Like the sun during the equinoxes to persons at the equator.

To us, for instance, who are situated about 53⅓° north of the equator (Dublin), the altitude of the polar star above the north point of the horizon is precisely the same number of degrees, that is, 53⅓°; and from what has been said, it is easy to conceive that the south pole of the heavens is depressed beneath the south point of the horizon in the same proportion, that is, 53⅓°. To us, and to all persons situated between the equator and the poles, the heavenly bodies appear to move in circles more or less inclined to the horizon; or, in other words, when one pole of the heavens is elevated above, and the other depressed below the horizon, the equator and all the circles parallel to it make *oblique* angles with the horizon. This is called an OBLIQUE position of the sphere

From what has been said, it will be easy to conceive that to persons in our latitude those stars that are within 53½° of the pole star will be constantly visible, except when obscured by the light of the sun or the vapours of the atmosphere. Those that are just 53½° from the pole star will, once in the course of their diurnal revolution, just touch the verge of the horizon; while those that are at a greater distance from it, will describe less or more of their diurnal circles below the horizon. In illustration of this, the teacher should point out to his pupils the most conspicuous of the *circumpolar* stars, that is, those stars which in performing their apparent diurnal revolutions about the pole, never reach so far as our horizon. The constellations of the Great Bear and Cassiopeia, which are on opposite sides of the pole star, and at about equal distances from it, will furnish the teacher with interesting examples.

The seven bright stars in the Great Bear, which are commonly called the Plough, and sometimes Charles' Wain, should be particularly noted. The two outside stars in the square of the Plough are called the POINTERS, because they, in every position, *point* to the polar star; that is, a line carried from *Merak*, the lower, through *Dubhé*, the upper star, for 29°, or *about five times the distance between them*, will bring the eye of the observer to the polar star.

To the mariners of old these constellations were of essential importance. The polar star, in particular, was their great guide, when leaving sight of land they ventured to embark upon unknown seas. The magnetic compass has enabled the mariners of the present day to steer their course over the pathless ocean with unerring certainty, even in the darkest night; and astronomical science has furnished them with other means of determining their position on the earth's surface; yet the polar star may still be regarded as the great celestial compass of the northern half of the world.

When the teacher has fully explained to his pupils the relations which exist between the celestial and terrestrial spheres, and illustrated the apparent motions of the heavenly bodies in the manner recommended, he should gradually introduce them to a knowledge of the facts and arguments which led to the discovery of the true system of the universe. The proofs of the diurnal motion of the earth are briefly stated in the second chapter of this work, to which the teacher should refer. These proofs the ILLUSTRATION in his hands will enable him to explain fully, and elucidate clearly.

For example, let him make the small globe in the centre, which represents the earth, turn round upon the needle or axis from *west* to east, while the outer or glass globe remains stationary, and his pupils will have little difficulty in comprehending how the apparent motion of the heavenly bodies from *east* to west, is produced by the real motion of the earth round its axis in the contrary direction. For, let them imagine themselves placed on that point of the inner globe which corresponds to their present position on the earth, and it will be easy to conceive that, while they turn round from *west* to east unconscious of their motion, the outer or glass globe which represents the heavens will *appear* to revolve round them in the contrary direction, that is, from *east* to west. When the eastern verge of their horizon approaches that part of the heavens in which the sun is situated, the day will begin to *dawn;* when their meridian comes opposite the sun, it will be *mid-day;* and when, by the continued motion of the earth round its axis to the eastward, the sun disappears beneath the western horizon, the day will be completed. Night will then commence, and the stars in like manner will appear to revolve round them till, by the rotation of the earth, that part of the heavens in which the sun is situated again appears above their eastern horizon.

In using this ILLUSTRATION we have supposed that the earth is in the centre of the celestial sphere, and that it always remains in the same position in space. Neither of these suppositions is, in point of fact, true, yet as far as the ILLUSTRATION and the *arguments* are concerned, they are both sufficiently accurate. For so immense—we might say, so *infinite*—are the dimensions of the visible sphere of the heavens, that an observer at any point within it would imagine himself to be in the centre. If we travel to the uttermost parts of the earth we would, as we do now, imagine ourselves to be in the centre of it; and if we could transport ourselves through the immensity of space to the most distant star, our position with regard to it would appear unaltered, that is, we would still imagine ourselves to be in the centre of the sphere of the heavens!

The earth, therefore, appears to be in the centre of the visible sphere of the heavens; and though it describes every year, in its motion round the sun, a circle nearly 200 millions of miles in diameter, its position with regard to the heavens appears to remain unaltered; that is, the earth in every part of its orbit appears to be in the centre of the celestial sphere!

This amazing and almost inconceivable fact has been illustrated in a preceding part of this work,[a] to which the reader is referred; and in the same chapter will be found a description of the earth's ANNUAL MOTION round the sun, with PROOFS and ILLUSTRATIONS.

We shall now give a brief description of the system of the universe.

The celestial sphere appears to *turn* round from *east* to west every 24 hours, carrying with it in the same time, and in the same direction, the sun, moon, and stars. Hence the term UNIVERSE[a] has been applied to the *whole* system of the heavens and heavenly bodies; or, in other words, to the whole range of creation.

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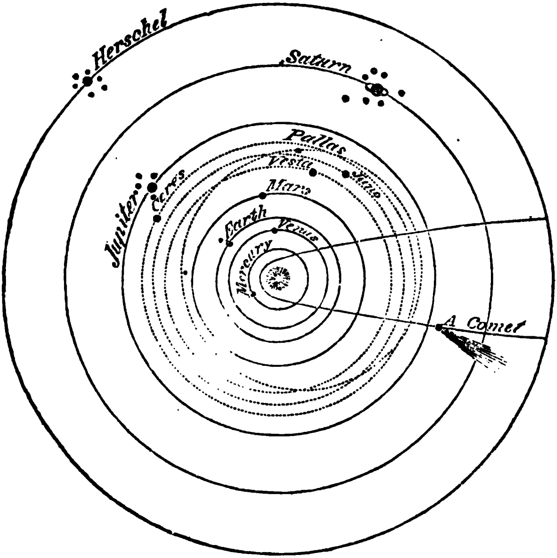
[a] See note, page 22.

That portion of the universe of which the SUN is the centre, is called the SOLAR system. This system consists of the sun, the stars called PLANETS, with their SECONDARIES or SATELLITES, and a certain number of COMETS.

SOLAR SYSTEM.



The planets, though they differ very little in appearance from the stars, are opaque bodies like the earth — and in fact, *the earth is a planet.* The light with which they shine is not their own, but received from the sun and eflected back, as in the case of the moon. Like the earth they revolve round the sun from west to east in orbits nearly circular. Like the earth, too, the planets, while revolving round the sun, turn upon their axes from west to east; and thus like it they have their days and their nights, their seasons and their years.

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[a] *Universe* — because the heavens and heavenly bodies appear to *turn* round in *one* and the same time.

The names of the PRIMARY planets are (in the order of their distances from the sun)—Mercury, Venus, the Earth, Mars, Vesta, Juno, Ceres, Pallas, Jupiter, Saturn, and Herschel, or the Georgium Sidus. Five of these planets, namely—Mercury, Venus, Mars, Jupiter, and Saturn, are visible to the naked eye, and were known to the ancients. The other five were discovered in modern times by the aid of the telescope; and there may be others yet undiscovered. Four of these planets are very small, and are called ASTEROIDS, namely—Vesta, Ceres, Pallas, and Juno.

The SECONDARY planets, or satellites, revolve round their primaries as their centres, and with them round the sun. The number of secondary planets as yet discovered is eighteen; namely—the MOON, which belongs to the earth, the *four* SATELLITES of Jupiter, the *seven* of Saturn, and the *six* of Herschel. Except the moon, none of the secondary planets are visible to the naked eye.

The description we have given of the FORM and MOTIONS of the EARTH in a preceding part of this work, is applicable to every planet in the system. They are all *spherical* bodies like the earth; and like it, they are carried round in their orbits by the counteracting forces of projection and gravitation.

What a gratifying announcement this must be to the pupils who have made themselves acquainted with the causes which account for the SPHERICITY and MOTIONS of the earth! Without any additional effort on their part—without even having formed any such expectation, they find themselves all at once, and as if by intuition, acquainted with the forms and motions of all the planets and all the satellites! Nay, the same principles, it may be presumed, operate beyond our system—"Where other planets circle other suns;" for there is every reason to conclude that every star in the universe, and their number is beyond all human computation, is the sun and centre of a planetary system!

The following table exhibits at one view the DIAMETERS of the several planets; their DISTANCES from the sun; the lengths of their DAYS and YEARS as measured by the time of their rotation upon their axes, and their periodic revolutions round the sun; and the different velocities with which they move in their respective orbits.

TABULAR VIEW OF THE SOLAR SYSTEM.

Names.	Diameter in English miles.	Mean Distance from the Sun.	Diurnal Rotation on Axis.				Annual Revolution round the Sun.				Mean Velocity in Orbit per hour.
			D.	H.	M.	S.	D.	H.	M.	S.	
Sun, . .	883,246	—	25	14	8	0	—				
Mercury, .	3,224	37,000,000		24	5	30	87	23	15	44	95,000
Venus, .	7,687	69,000,000		23	20	19	224	16	49	11	75,000
Earth, .	7,912	95,000,000		23	56	4	365	6	9	8	68,000
Moon, .	2,180	95,000,000	27	7	43	0	365	6	9	8	
Mars, .	4,189	144,000,000	1	0	39	22	686	23	30	35	53,000
Vesta, .	238	225,000,000	—				1,335	4	55	12	
Juno, .	1,425	250,000,000	—				1,590	23	57	7	
Ceres, .	—	260,000,000	—				1,681	12	56	10	
Pallas, .	—	260,000,000	—				1,681	17	0	58	
Jupiter, .	85,950	490,000,000		9	53	37	4.332	14	27	11	25,000
Saturn, .	79,042	900,000,000		10	16	2	10,759	1	51	11	21,000
Herschel,	35,112	1,800,000,000	—				30,689	0	0	0	16,000

OBSERVATIONS UPON THE PLANETARY SYSTEM.

PLANETS.—The stars called *planets*[a] were so denominated because they appear as if *wandering* through the heavens. At one time they are seen to move from *west* to east; at another, in the contrary direction—that is, from *east* to west; and at other times they appear to stand still, as if uncertain which way to move.

> Their *wandering* course, now high, now low, then hid;
> Progressive, retrograde, or standing still. MILTON.

These motions appeared to the ancients intricate and mysterious, because they were ignorant of the *true* system of the heavens; but to us who are acquainted with it, they appear simple and natural. In fact, as we observed before, the motions of the planets are in all respects like the motions of the earth. Like it, they move in their orbits from west to east, by south, round the sun; and like it they turn upon their axes in the same direction—that is, from west to east.

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[a] *Planets*, from the Greek πλανηται, *wanderers*.

If we were in the middle of a *circular* race-course, the horses would appear to move regularly round and round us; but if we are at the distance of two or three miles from such a course, the motions of the horses would no longer appear regular. For suppose the course were in a southern direction from us, and that the horses started at the side of it farthest from us, with their heads towards the east, and it will be evident that, though galloping regularly round the course as before, their motions would appear to us to be irregular—and, if we are ignorant of the cause, inexplicable. While describing the off-side of the course they will appear to us to move from *west* to east; while rounding it in the direction of the place in which we are supposed to stand—that is, while *approaching us in a straight line*, they will appear to be without motion; while galloping round the side nearest to us, they will appear to move from *east* to west—that is, in the contrary direction from which they set out; and finally, they will appear again to be stationary while moving round from us in a straight line.

Now let us apply this to the planetary system. If we could view the planets from the centre of the system—that is, from the sun, they would all, including the earth, appear to move regularly round and round us, in orbits proportioned to their respective distances from the sun; but as we view them from the earth, which is *not* in the centre, their motions must necessarily appear irregular. At one time their motions will appear to be from *west* to east—that is, *direct*;[a] at another, from *east* to west, or *retrograde*; and at other times they will appear to be without motion, or *stationary*—just as the motion of the horses in a *circular* race-course would appear if viewed from *without*, at the distance of two or three miles.

Names of the planets.—We have seen, page 26, that the nearer the earth is to the sun, the greater is its velocity in its orbit; and the same principles apply to all the planets. Hence we may conclude that the nearer a planet is to the sun, the greater is its velocity in its orbit. **Mercury**, therefore, travels quicker in his orbit than any of the other planets, and from this circumstance he appears to have derived his name. For in the heathen mythology, *Mercury* was the messenger of the gods; and *speed* is an essential quality in a messenger.

Venus approaches much nearer to the earth than any of the other planets, and hence she appears to us the largest, the brightest, and the most *beautiful* of them all. From this circumstance she derives her name.

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[a] *Direct* motion. That is, in the order of the Signs.

Mercury and Venus are called *inferior* planets, because their orbits are *within* the earth's orbit: that is, between it and the sun. The other planets are called *superior*, because their orbits are *without* or beyond the orbit of the earth. (*Interior* and *exterior* would be more appropriate terms.)

When viewed through a telescope, Mercury and Venus present phases similar to those of the moon; from which it follows that they do not shine with their own light, and also that the orbits in which they revolve are between the earth and the sun. When Mercury or Venus is in a line between the earth and the sun, a TRANSIT takes place. On such occasions the planet appears to cross the sun's disk like a dark spot. If the planes of the orbits of Mercury and Venus lay exactly in the plane of the earth's orbit, transits would take place at every *inferior* conjunction. But, like the moon, they pass, except on rare occasions (particularly Venus), either a little above or a little below the sun.—See page 24. The transits of Venus (by which the distance of the earth from the sun is determined) can occur only twice in a century, because it is only twice in that time that any number of complete revolutions of Venus are just or nearly equal to a certain number of the earth's revolutions. The next transit of Venus will occur in 1874.

When Venus rises before the sun, which she does when she is to the west of him, she is called *Lucifer*, or the *Morning Star;* and when she is east of the sun, and consequently sets after him, she is called *Hesperus*, or the *Evening Star*. If Venus could be seen by us when she is in *inferior* conjunction, she would appear like a brilliant moon, but when she is in that position with regard to the earth, her darkened hemisphere is next us.

MARS is distinguished from the other planets by his red, fiery appearance; and hence, it is probable, the ancients bestowed upon this planet the name of the god of war. The colour of Mars is occasioned by the great density of his atmosphere, through which only the strong *red* rays of light are able to penetrate. The colour of the sun during a fog, or when near the horizon, where the atmosphere is densest, is an illustration of this.

VESTA, JUNO, CERES, and PALLAS, were denominated *asteroids*,[a] because they present a variety of anomalies that distinguish them from the other planets. They are supposed to be the fragments of some large planet, which, at some remote period, may have burst in consequence of some internal convulsion.

JUPITER is the *largest* of all the planets, and hence the ancients gave him the name of the father of the gods. Though so far from the earth and sun, he appears to us nearly as large, and almost as brilliant, as Venus.

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[a] ASTEROIDS, that is, *like* or resembling *stars*. Compare Spheroid, page 8.

Particularly when he is seen in that part of his orbit which is nearest to the earth. When viewed through a telescope he is found to be attended by four SATELLITES or moons, which exhibit, on a small scale, and in short periods, most of the *phenomena* of the solar system. And as they pass through his shadow, as the moon does through the earth's, they are frequently and regularly undergoing eclipses. For the most part, two of them are above his horizon at the same time; and so rapidly do they change their appearance—particularly the first or nearest, that in the short space of 42 hours it presents all the *phases* of the moon, from the thin crescent to the full orb, undergoing an eclipse itself, and causing an eclipse at the surface of Jupiter within the same period. This satellite, as seen from Jupiter, appears four times as large as our moon. The next, or second satellite, completes its revolution in about 3½ days, or *half* a week; the third, in about *a week;* and the fourth, or farthest, in something more than *two weeks.*

By means of the eclipses of Jupiter's satellites it was discovered that the motion of light is progressive, and not instantaneous, as it was formerly supposed. It was observed, for instance, that an eclipse of any of these satellites is seen 16 minutes sooner when Jupiter is at his least distance from the earth than when he is at his greatest; from which it follows, that it takes light 16 minutes to travel over the diameter of the earth's orbit, that is 190 millions of miles. The rays of light, therefore, issuing from the sun, reach the earth in about 8 minutes; that is, light travels at the rate of about 12 millions of miles in a minute—a velocity more than a million of times greater than that of a ball issuing from the mouth of a cannon!

The eclipses of Jupiter's satellites have also furnished navigators with a method for determining their longitude.—See page 45.

Jupiter is also distinguished for his BELTS, which, when viewed through a telescope, appear like bands or zones parallel to each other, and in general, to his equator. Some of them are dark, and others luminous; and as they frequently change their number and appearance, they are supposed to be clouds formed into strata by trade winds blowing round his equatorial regions; the dark bands being clouds, and the luminous ones the body of the planet seen between them.

SATURN, according to the heathen mythology, was the father of Jupiter, and hence his name was given to this planet, because it was supposed to be the farthest out in the system. For a similar reason the Continental astronomers call Herschel or the Georgium Sidus, by the name of the oldest heathen deity, URANUS; Saturn being fabled to be the son of *Uranus* and Terra—that is, of the *heavens* and the earth.

Saturn, when viewed through a telescope, is found to be attended by seven satellites or moons. But what particularly distinguishes this planet is the magnificent RING of light which encircles it. This ring is more brilliant than the planet itself; and when examined attentively, it is found to be divided into two distinct parts by a dark band, so that there are at least two rings, and probably more. These rings lie in the plane of Saturn's equator, and are probably of great use in reflecting the light of the sun to this distant planet.

DIAMETERS OF THE PLANETS.—If we know the *diameters* of the planets we can tell their actual and relative magnitudes. This column of the table is, therefore, of great importance. To assist the memory, it is recommended to take the following remarkable combinations of figures as expressive of the diameters of the sun and the planets:—888,000, 88,000, 80,000, 8,000, 4,000, 3,000, 2,000. The first number gives the sun's diameter in English miles; the second (dropping an 8) gives Jupiter's; the third, Saturn's; the fourth, the diameters of the earth and Venus; the fifth (the half of 8), that of Mars; the sixth (the next number to 4), Mercury's; and the seventh (the next number to 3), the moon's.

The preceding combinations of figures give us a sufficiently accurate idea, and one which we are not likely to forget, of the diameters of all the planets, except Herschel and the asteroids. In some instances the numbers given are a little too high, and in others a little too low; but they are sufficiently accurate for a general idea. In fact, the authorities differ with regard to the precise length of the diameters of most of the planets.

The diameter of a globe is equal to about one-third of its circumference (as 7 to 22 nearly.) Hence, if we know the diameter of a planet, we can tell its circumference; and by multiplying the circumference by the diameter, we get its superficies, or the contents of its surface; and by multiplying the superficies by the sixth part of the diameter, its solid contents.

The superficies or surfaces of spherical bodies are proportional to the squares of their diameters, and their solid contents or masses to the cubes of their diameters. Hence the relative magnitudes of the sun and the planets are calculated. The diameter of Saturn, for instance, is to the diameter of the earth as 10 to 1 (80,000 to 8,000); and as the square of 10 is 100, the surface of Saturn is 100 times greater than the surface of the earth. Again, the diameter of the earth is to that of the moon as 4 to 1 (8,000 to 2,000); and hence their surfaces are as the square of 4 to the square of 1—that is, as 16 to 1. The earth, therefore, appears about 16 times as large to the inhabitants of the moon, as the moon does to us.

The *real* diameters of the sun and planets are calculated from their apparent diameters and actual distances. The apparent diameter of the sun subtends an angle of about *half* a degree. That is, if from the eye of the observer two lines are supposed to be drawn, one to the top of the sun and the other to the bottom, they will include an angle of rather more than half a degree. (In winter, when the sun is nearest to us, the angle subtended by the diameter of the sun is 32′ 30″, and at midsummer, 31′ 30″.) The apparent diameter of the sun, therefore, will enable us to judge of angular distances upon the surface of the heavens. If two stars, for instance, appear to be about 10 times the apparent diameter of the sun from each other, they are about 5 degrees apart.

DISTANCES OF THE PLANETS FROM THE SUN.—By taking the following figures as expressive of the mean distances of the planets from the sun, *in millions of miles*, the memory will be greatly assisted:—Mercury, 36; Venus, 69; the Earth, 95; Mars, 144; Jupiter, 490; Saturn, 900; Herschel, 1800. In the first number we get the second figure (6) by doubling the first (3); the last figure (6) in the first number is the same as the first in the second, and the second figure in the second number (69) will be easily recollected from the proportions 3, 6, 9. By transposing the figures which express the distance of Venus (69), we have the earth's very nearly. The square of 12 (144) gives us the distance of Mars (144); the last figure in the preceding number (4) suggests 490, the distance of Jupiter; the 9 in 490 suggests 900, the distance of Saturn; and *twice* the distance of Saturn gives us the distance of Herschel, namely, 1800 millions of miles—that is, nearly 19 times more distant from the sun than the earth is! By looking at the numbers this will be easily understood—36, 69, 95, 144, 490, 900, 1800.

The squares of the periodic times of the planets are proportional to the cubes of their distances from the sun. Hence, as the distance of the earth from the sun has been found by the transits of Venus to be about 95,000,000 miles, we can determine the distance of any other planet, if we know its periodic time—that is, the time in which it completes its revolution round the sun. For instance, as the square of 365 (the periodic time of the earth), is to the square of 88 (the periodic time of Mercury), so is the cube of 95,000,000 (the mean distance of the earth), to a fourth number, which will be the cube of the distance required. And if the cube root of this be extracted, the answer will be about 36,000,000 of miles. This important law was discovered by Kepler, and fully demonstrated by Sir Isaac Newton.

ROTATION OF THE PLANETS.—The following will give a clear and *permanent* general idea of the length of the DAYS of the principal planets, as measured by the time which they take to turn once round upon their axes before the sun:—The length of the days of Mercury, Venus, and Mars, is much the same as the length of those of the earth—that is about 24 hours. Or, in other words, the length of the days of the *four* planets next the sun (including the *earth*) is nearly the same—that is, about 24 hours; while the length of the days of the two next planets, namely, Jupiter and Saturn, is *not half* so long as that of the earth's—that is, under 12 hours.

ANNUAL REVOLUTION OF THE PLANETS.—The YEARS of the planets are measured by their periodic revolutions round the sun. The following will give a *general* idea of the length of each:—the length of Mercury's year is about *one-fourth* of the earth's, that is, about 3 months. The year of Venus is about *two-thirds* of the earth's, that is, about 8 months. The year of Mars is nearly twice as long as *ours.* Jupiter's year is nearly equal to 12 of ours—that is, a year with us would only be a *month* at the planet Jupiter; Saturn's year is nearly equal to 30 of ours; and Herschel's is more than 84 times as long. Scarcely *two-thirds* of this planet's year have elapsed since its discovery in 1781!

VELOCITIES OF PLANETS IN THEIR ORBITS.—The following figures will be easily recollected:—Mercury travels in his orbit at the rate of 95,000 *miles an hour;* Venus, 75; the Earth, more than 65; Mars, nearly 55; Jupiter, 25; Saturn, more than 20; and Herschel, more than 15.

From the distances and periodic times of the planets, their mean velocities in their orbits are easily calculated. The earth's distance from the sun, for instance, is about 95,000,000 of miles, and its periodic time is about 365 days. Hence, if the earth describes a circle, the semidiameter of which is 95,000,000 of miles, in 365 days, what portion of its circumference will it describe in one day? And if it travels so much in 24 hours, what will be its motion per hour?

ORBITS OF THE PLANETS.—The ORBITS of the planets are *elliptical;* but compared with their great magnitudes, they differ little from perfect circles. In fact, they are just like the earth's; and like the *plane* of its orbit, all their planes pass through the centre of the sun.—See page 28.

INCLINATION OF THE ORBITS OF THE PLANETS.—The planets move round the sun in nearly the same plane or level.[a] These are, however, inclined to each other at small angles, and as they all pass through the centre of the sun, they intersect each other. None of their planes make a greater angle with that of the earth's than seven degrees and a few minutes; while most of them make smaller angles with it.[b]

FIGURES OF THE PLANETS.—The planets, like the earth, are *oblate* spheroids, and from the same causes.—See note, p. 37. From the great rapidity with which Jupiter and Saturn turn on their axes, we should expect that they are much more *oblate* than the other planets, and such is the fact. The *equatorial* diameter of Jupiter is to his polar as 14 to 13; and Saturn's equatorial diameter exceeds his polar in nearly the same proportion.

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[a] *Inclination of orbits to the ecliptic.*—Mercury, 7 deg. 9 min.; Venus, 3 deg. 23 min. 28 sec.; Mars, 1 deg. 51 min. 6 sec.; Vesta, 7 deg. 8 min. 9 sec.; Juno, 13 deg. 4 min. 9 sec.; Ceres, 10 deg. 37 min. 26 sec.; Pallas, 34 deg. 34 min. 55 sec.; Jupiter, 1 deg. 18 min. 51 sec. Saturn, 2 deg. 29 min. 35 sec.; Uranus, 46 min. 28 sec.; the Moon, 5 deg. 9 min. 3 sec.

[b] Except the *asteroids*, Juno, Ceres, and Pallas.

The equatorial diameter of Jupiter is more than 6,000 miles longer than his polar one. Hence, when viewed through a good telescope, he appears to be oval.

DENSITIES OF THE PLANETS.—The density of bodies is ascertained by comparing their *bulk* with their *weight*—or, in other words, with the *quantity of matter* which they contain. And as the power of attraction in any body is in proportion to the quantity of matter which it contains, the densities of the planets have been determined by comparing their magnitudes with the power of attraction which they exert on other bodies in similar circumstances.

If the density of water be taken as 1, the Sun will be $1\frac{2}{7}$; of Mercury, $9\frac{1}{6}$; of Venus, $5\frac{11}{15}$; of the Earth, nearly 5; of the Moon, $3\frac{1}{2}$; of Mars, $3\frac{3}{4}$; of Jupiter, $1\frac{1}{24}$; of Saturn, $0\frac{5}{9}$; of Herschel, $0\frac{22}{100}$.

The density of the sun is little more than the density of water, while the average density of the earth is nearly *five* times that of water. Hence the density of the earth is nearly *five* times as great as the density of the sun; but so great is the magnitude of the sun, that it contains about 333,000 times as much matter as the earth—or more than 600 times as much as all the planets taken together!

THE SUN'S ATTRACTION, LIGHT, HEAT, &c.—The sun's ATTRACTION, LIGHT, HEAT, and APPARENT MAGNITUDE with respect to the planets, are supposed to be inversely proportional to the squares of their distances from him. Hence, it the earth were where Mercury is, the sun would appear to us nearly seven times as large as it now does, and his heat, light, and attractive powers would be increased in the same proportion; for the squares of the distances of the earth and Mercury from the sun are nearly as 7 to 1. Again, Herschel's distance from the sun, compared to Saturn's, is as 18 to 9 (1800 millions to 900), that is, as 2 to 1; and, consequently, the attraction, heat, light, and apparent magnitude of the sun at Herschel are *four* times less (the square of 2) than they are at Saturn. We are not, however, to measure the degrees of heat and cold experienced at the planets with reference to our own. We are ignorant of their structure, surfaces, and atmospheres, and we cannot therefore know what effect may be produced upon them by the solar rays. We have no reason, therefore, to conclude that the planets are either too warm or too cold to be inhabited. One thing we may conclude—that the All-wise and All-good Creator has made nothing in vain.

THE MOON.—The MOON revolves round the earth in a *month*, and with the earth she is carried round the sun in the course of a year. And as she always presents the same face or side to the earth, it follows that she must turn once round her axis in the course of a month. For if she had no rotation on her axis, every part of her surface would be presented to the earth in the course of her revolution round it. Hence, as the moon turns but once round her axis in a month, before the sun, her *day* and *night* must be each nearly a fortnight long. And as the moon enlightens the earth by reflecting the light of the sun, so the earth illumines that side of the moon that is next to it, while turned away from the sun. The half of the moon which is towards the earth may be said, therefore, to have no darkness at all; for during the fortnight in which it is turned away from the sun, the earth shines upon it with a disk fifteen times as large as that of the full moon. The inhabitants of the other half of the moon never see the earth at all, and are therefore in darkness for the half of every month, with the exception of the light which they receive from the stars.[a]

The distance of the moon from the earth is about 240,000 miles. Her *apparent* diameter is about equal to that of the sun's, though it is really 400 times less; but this is because she is 400 times nearer to us than the sun is.

When the moon is between the earth and the sun, her enlightened hemisphere is turned from us, and the side which is next to us is darkened, and therefore invisible. She is then said to change. As she proceeds in her course she turns a bright edge towards us, which we call the *new moon*. If we observe her next evening, we shall find that she has moved about 13° farther east of the sun than on the preceding evening, and that her crescent of light has increased in breadth. Repeating our observations, we shall find that, as she progresses eastward from the sun, her enlightened surface comes more and more into view till she arrives at her *first quarter*, and comes to the meridian at sun-set. She has then completed half her course, from the *new* to the *full* moon; and as half of her enlightened disk is turned towards the earth, we say it is *half moon*. After her first quarter she is said to be *gibbous*,[b] because she presents more than half of her enlightened hemisphere to the earth. And as she recedes farther and farther from the sun, she appears more and more gibbous till she completes half of her revolution round the earth, and is seen rising in the east when the sun is setting in the west. She then presents the *whole* of her enlightened hemisphere to the earth, and it is then said to be *full moon*. In this position the moon is said to be in *opposition*, because she is then on the *opposite* side of the earth with respect to the sun; or, in other words, the earth is between her and the sun. And at new moon she is said to be in *conjunction*, because she is between the earth and the sun.

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[a] Unless they pass over to the hemisphere next the earth.

[b] From *gibbus*, L., *hunch*-backed, convex.

As she proceeds in her orbit she becomes gibbous again, and presents the same changes as before, but in an inverted order, till we see her in the morning like a fine thread of light, a little to the west of the rising sun. For the next day or two she rises in conjunction with the sun, and is consequently lost to our view till, having passed the sun to the eastward, we hail her appearance again as the NEW MOON!

The crescent or illuminated part of the moon is always turned in the direction of the sun. After her conjunction, therefore, or while she is *increasing*, the convex part of the crescent is turned to the west, and the horns or hollow part of it to the east. Before her conjunction, or while she is *waning*, the reverse takes place. These different *appearances* of the moon are called her PHASES, and they prove that she shines not by her own light; for if she did, she would always present to us a full enlightened orb like the sun.

If we observe the motion of the moon in connexion with the position of any fixed star, we shall be convinced that she moves from *west* to east, and not from east to west, as she *appears* to do. For if the star is to the *eastward* of the moon, the distance between them will gradually diminish till they appear in the same direction from our eye. The moon will then pass to the *eastward* of the star, and the distance between them will gradually increase. In 24 hours after we shall find that the moon has moved 13 degrees to the eastward; and if we continue our observations we shall find that in 27 days, 7 hours, and 43 minutes, she having made the circuit of the heavens, will again be in a line with the same fixed star. This is called a periodic or *sidereal* revolution of the moon. But though the moon makes a complete revolution round the earth in 27 days, 7 hours, and 43 minutes, it requires 2 days and 5 hours additional to bring her to that position in which the same face will be presented to the sun. This period, which is called a *synodical* month, consists of 29 days, 12 hours, and 44 minutes, and it is reckoned from *new* moon to *new* moon. This difference arises from the earth's annual motion in her orbit; for while the moon is revolving round the earth, the earth is advancing in her orbit. The moon, therefore, after completing one revolution, will have to move several degrees farther before she can come again into the same position with respect to the earth and sun. This may be illustrated by the motions of the hands of a watch. At 12 o'clock they start together, and at one, the minute-hand having made a complete revolution round the dial, is on a line with XII. But, in the meantime, the hour-hand has moved forward in its course as far as I; and it will consequently take the minute-hand five minutes, in addition to the hour, to overtake it.

MAGNITUDE OF THE EARTH.—As the magnitude of the earth is the scale or standard by which we are enabled to form a conception of the magnitudes of the heavenly bodies, and of the immensity of the universe, we should endeavour to impress the minds of our pupils with adequate ideas of its vast extent. In a preceding part of this book its dimensions as a globe, and the extent of its surface in square miles have been given (pp. 31 and 123); but, as mere calculations are seldom *realized* by young persons, something should be done to give them a practical and *intuitive* proof of its amazing magnitude. With this view they should be conducted to some elevated place in the neighbourhood, and be told to look around them. A simple Irishman once exclaimed, in looking round him from the top of an ordinary-sized mountain in this country, which he, with others, had just ascended, "*Well, I never before thought the world was half so big!*" Such, no doubt, will be their feeling—but how will it be increased, when they are told that vast as the landscape before them is, it is little more than a mere spot, when compared with the whole extent of the surface of the earth! For even if it should comprise a circle of 150 miles in circumference, it would scarcely amount to the hundred thousandth part of the earth's surface. We should therefore have to conceive 100,000 landscapes as large as the one we are contemplating, before we could form an adequate idea of the magnitude of the earth!

MAGNITUDE OF THE SUN.—But what is the magnitude of the earth, amazing as it is, when compared to the magnitude of the sun? The length of the sun's diameter is, as we have seen, about 888,000 miles, that is, nearly four times the distance of the moon from the earth (240,000). Hence, if the centre of the sun were in the exact situation in which the centre of the earth now is, its surface or body would extend to the moon, and 200,000 miles beyond it; or, in other words, about twice as far as the moon!

Again, if the sun were a hollow sphere, and our earth, as large as it now is, in the centre of it, the distance between the earth and the inner surface of the sun would be 440,000 miles.[a] Half-way between us and the inner or concave surface of the sun, might be the moon, as large as she now is, and at the same distance from us; and if perforations were made in the surface of the sun, so as to admit the luminous matter with which it is covered, to represent the stars, the appearance presented to us would differ little from that of the visible heavens; that is, the concave surface of the sun would appear to be as distant and as large as the whole universe appears to the ordinary observer!

RECENT DISCOVERIES IN ASTRONOMY.

NEPTUNE.—We can do little more here than direct the attention of the young student to the brilliant discoveries which have been recently made in this wonderful science. On the night of the 23rd of September, 1846, a planet, which has been called *Neptune*, was discovered at a point in the heavens, upwards of 2,862 millions of miles from the sun, that is, more than 30 times the distance of our earth from that luminary! But more wonderful still, the existence of such a planet had been confidently predicted by several astronomers long before its discovery; and at length, by one of the most difficult problems ever solved by human ingenuity, the exact place in the heavens in which it would be found at a given time, was determined. The problem referred to is called the *inverse problem of perturbations*. The usual problem is: given a disturbing cause, its amount and direction, to find the effect on the body disturbed. This problem is comparatively easy, because it is known, from the nature of attraction, that the disturbing influences of the planets upon each other, will always be in proportion to their masses and proximity. But in the *inverse* problem it is required to find, from certain observed disturbances, the position and path of the body producing them. The successful solution of this most difficult problem led to the discovery of Neptune. It had been found that the *perturbations* of Uranus, that is, certain irregularities in his motion and path, could not be accounted for, either by the separate or combined influences of the planets between him and the sun; and hence it was ingeniously conjectured that they must be occasioned by some unknown planetary body, moving beyond his hitherto considered most distant orbit.

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[a] That is, the semi-diameter of the sun, *minus* the semi-diameter of the earth.

The honour of this memorable discovery, belongs equally to M. Le Verrier, an eminent French mathematician, and Mr. Adams, a distinguished member of the University of Cambridge, who, unconscious of each other's labours arrived almost simultaneously at the same result. Mr. Adams, indeed, had completed his observations a few weeks before M. Le Verrier, and had requested the Cambridge Professor of Astronomy to search for the planet in the direction in which he computed it would be found; but, unfortunately for him, some delay took place, and thus he lost the honour of being the first discoverer. For in the mean time, the discovery was announced by Dr. Galle, of the Berlin Observatory, who had been requested by M. Le Verrier to employ the great telescope at his command in looking out for it, on the night of the 23rd of September. This was promptly done, and within twice the moon's breadth of the spot indicated by M. Le Verrier, the planet NEPTUNE was discovered!

The mean distance of Neptune from the sun is 2,862,457,000 miles; his periodic revolution is 60,126·71 days, or rather more than 164½ years; and his real diameter about 31,000 miles. One *satellite* has already been discovered in attendance upon him, and it is conjectured there are others. There is also an indication of *rings*, as in the planet Saturn.

NEW ASTEROIDS.—More than 300 years ago, Kepler, the great German astronomer, predicted that a planet would be found between the orbits of Mars and Jupiter; but, though no planet such as he indicated has been discovered in that region of the heavens, yet it may be said that several *fragments* of it have been found. These fragmentary planets have been denominated ASTEROIDS.—See page 139. The *four* asteroids referred to were discovered about the beginning of the present century; and the *thirteen*, whose names we now add, within the last few years:—Astrea, Hebe, Iris, Flora, Metis, Hygeia, Victoria, Parthenope, Egeria, Irene, Eunomia, Thetis, and Melpomene.

ASTRONOMICAL TERMS.

[As definitions or explanations of the following TERMS have been given in the preceding part of this work, it will be sufficient to refer the reader to the pages in which each may be found.]

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SUPPLEMENTARY DEFINITIONS.—An Artificial Globe is a miniature representation of the earth or heavens. The one that represents the *earth* is called a Terrestrial, and the one that represents the *heavens* a Celestial Globe. Each globe is hung in a brass ring called the Brazen or Universal Meridian, and turns upon an axis or wire which passes through each pole. The Brazen Meridian is divided into four quadrants of 90 degrees each, two of which begin at the equator and increase towards the poles, which serve to show the latitude of places on the Terrestrial Globe, and the declination of the sun moon and stars, on the Celestial. The other two quadrants are numbered from the poles to the equator, and serve to elevate or depress the poles above or below the horizon for any latitude.

The Brazen Meridian is let into two notches made in a broad flat ring called the Wooden Horizon, the upper surface of which divides the globe into two equal parts called the Upper and Lower Hemispheres: one of the notches is in the North point of the horizon, and the other in the South. The graduated side of the Brazen Meridian faces the Eastern side of the horizon. The Wooden Horizon is divided into three concentric circles, the innermost of which contains the several points of the Mariner's Compass; the next has the signs, characters, and graduations of the Twelve Signs of the Zodiac; and the exterior one is a Calendar of the several months and days. By the two last the sun's place in the ecliptic may be readily found for every day in the year.

At the north pole of each globe there is usually affixed a small circle of brass called the Hour Circle, because divided into hours and minutes, and furnished with an Index-hand, which goes over all the twenty-four hours as the globe itself is turned on its axis. The motion of the Terrestrial Globe being from west to east, (like the earth which it represents,) the hours increase in this direction; but the motion of the Celestial Globe being from east to west (like the apparent motion of the heavens,) the hours increase accordingly. Some globes have no brass plate, but have the Hours marked on the Globe itself.

The Quadrant of Altitude is a thin slip of brass divided into degrees, and corresponding to a quadrant or fourth part of the Equator and Brazen Meridian. It is used for measuring the distances and positions of places on the Globe.

The Elevation of the Pole at any place is the height of the Pole above the Horizon of that place measured on the Meridian. It is always the same number of degrees as the Latitude (see page 39.)

The Latitude of a heavenly body is its distance north or south from the *ecliptic*. The sun has no latitude because he is always in the ecliptic.

The Longitude of a heavenly body is its distance from the first point of Aries, measured on the ecliptic *eastward* round the globe.

The Right Ascension of a heavenly body is its distance east from the first point of Aries measured on the equator.[*]

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[*] It is easy to convert Right Ascension into time, or time into Right Ascension; for if a heavenly body is one hour in passing over 15°, it

Declination and Right Ascension in the heavens, correspond to Latitude and Longitude on the earth.

Vertical Circles are circles supposed to be drawn through the Zenith and Nadir of any place, cutting the horizon at right angles.

The Prime Vertical is that which passes through the east and west points of the horizon, cutting the meridian of the place at right angles.

The Azimuth of a heavenly body is that arc of the horizon, intercepted between a vertical circle passing through the object, and the north or south points of the horizon.

The Amplitude of a heavenly body is that arc of the horizon, comprehended between an object at rising or setting, and the east or west points of the horizon.

The Colures are two great circles which pass through the poles of the heavens, dividing the ecliptic into four equal parts, and mark the seasons of the year. The Equinoctial Colure passes through the Equinoxes at Aries and Libra; and the Solstitial Colure passes through the Solstitial points, or the points of the sun's greatest declination north and south.

SKETCH OF THE HISTORY OF ASTRONOMY.—The science of Astronomy was cultivated in the first ages of the world by the Chaldeans, Egyptians, and Phœnicians;[a] and, according to Josephus, by the immediate descendants of Adam, particularly by the sons of Seth. In the Book of Job several of the constellations are mentioned; as—"Canst thou bind the sweet influences of the *Pleiades*, or loose the bands of *Orion?* Canst thou bring forth *Mazzaroth* in his season, or canst thou guide *Arcturus* with his sons?" And in the works of the oldest of the heathen poets, Hesiod and Homer, similar allusions are made to the constellations into which the principal stars must at that early period of the world have been grouped.

The Greeks derived their first knowledge of astronomy from Egypt, through Thales, the Milesian, who flourished about 640 years before the Christian era. He was so well acquainted with the motions of the heavenly bodies, that he explained eclipses, and even predicted one. He also taught the sphericity of the earth, and divided it into five zones.

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will be one-fifteenth of an hour, or four minutes, in passing over 1°. If the first point of Aries, for instance, be on the meridian at 12 o'clock, the next hour line, which is 15° east of it, will come to the meridian at 1 o'clock; the second hour line at 2 o'clock; the third, at 3 o'clock, and so on. Of any two bodies whose Right Ascension are given, that one will pass the meridian *first* which has the least Right Ascension; and in the proportion of 1 hour for every 15 degrees.

[a] The Chinese were from a very early period of the world acquainted with many astronomical principles; particularly with the nature of eclipses.

The solstices and equinoxes he also explained; and divided the year into 365 days. His disciples and successors, particularly Pythagoras and his pupil Philolaus, maintained the same opinions, but with so little success, in consequence of the opposition of the people, who judged only from the evidence of their senses, that the true doctrine of the heavens was after their time lost to the world for two thousand years.

About 130 years after the Christian era, Ptolemy, a celebrated Egyptian philosopher, published what has been called the Ptolemaic System of Astronomy. According to this system, the earth is at rest in the centre of the universe, and the heavens revolve round it from east to west in 24 hours, carrying with them in the same time, and in the same direction, the sun, moon, and stars. The difficulties of his system, such as the retrograde motions and stationary appearances of the planets, he endeavoured to explain by the introduction of cycles, epicycles, and other ingenious, but scarcely intelligible hypotheses. This system, though false in fact and absurd in theory, was believed and maintained for 1400 years.

In 1530, Nicholas Copernicus, a native of Thorn in Polish Prussia, discovered and published to the world the system of the universe which goes by his name. The truth of his system was afterwards fully established by Kepler, Galileo, and Newton; and is now by the learned of all countries universally believed.

PROBLEMS ON THE GLOBES.

PROBLEM 1.—*To find the latitude and longitude of any place.*

1. Turn the globe till the given place comes exactly under the brazen meridian, and the degree marked over it is the latitude required. 2. The globe remaining in this position, the degree of the equator cut by the brazen meridian is the longitude required. Thus, Dublin will be found to be 53° 21′ N.L., and 6° 18′ W.L.

Exercises.—1. Find the latitudes and longitudes of the capitals of Europe; also, of the principal cities of Asia, Africa, and America. 2. Find all the places which have no latitude. 3. Find all the places which have no longitude. 4. Find the place which has neither latitude nor longitude. 5. Find those places which have the greatest latitude and longitude.

PROBLEM 2.—*The latitude and longitude of any place being given, to find it on the globe.*

1. Look for the given longitude on the equator, and bring it to the graduated side of the brass meridian; then under the given degree of latitude on the meridian is the place required. Thus, suppose we are told that two ships met in 36° 20′ N.L., and in 32° W.L., we shall find that it must have been in the Atlantic Ocean, a little to the south of the Azores.

Exercises.—1. Find all those places which have the same latitude at any given place. 2. Find all places having the same longitude at any given place. 3. What towns and places lie nearly in the following latitude and longitude?

N.L. 41°, and E.L. 29°.
S.L. 33°, and W.L. 71° 30′.
N.L. 22° 34′, and E.L. 84° 22′.
S.L. 34° 25′, and W.L. 58° 16′.
N.L. 40° 42′, and W.L. 74°.
S.L. 15° 55′, and W.L. 5° 42′.
N.L. 48° 50′, and E.L. 2° 20′.
S.L. 12° 2′, and W.L. 77° 7′.

PROBLEM 3.—*To find the difference of latitude or longitude between any two places.*

1. If the places be in the same hemisphere, subtract the latitude of the one from the other; if in different hemispheres, add the latitude of the one to that of the other. 2. If the longitudes of the places in question are both in the same direction, that is, both east or both west, subtract the less from the greater, and the remainder will be the difference required; but if the longitude of the one place is east, and the other west, add their longitudes together, and the sum will be the difference required.[a]

PROBLEM 4.—*To find the distance between any two places on the globe.*

Lay the graduated edge of the quadrant of altitude over both the places, and count the number of degrees intercepted between them; which being multiplied by 60 for geographical, or $69\frac{1}{10}$ for English miles, will give the distance required. When the distance is more than 90°, stretch a thread from the one place to the other, and measure the distance on the equator. Thus, the distance between London and Rome will be found to be 12° 45′, or 881 miles.[a]

PROBLEM 5.—*To rectify the globe for the latitude of any place.*

Elevate the north or south pole above the horizon as many degrees as are equal to the latitude of the given place. Thus, if the place be Dublin, the north pole should be elevated 53° 21′ above the horizon (because that is the latitude of Dublin.)

PROBLEM 6.—*To find the bearing or direction of one place from another.*

Rectify the globe to the latitude of one of the places, and bring it to the brass meridian; then fix the quadrant of altitude over that place, and extend it from thence to the other, and the end will point out the direction upon the horizon. Thus, if it were required to know the direction of Rome from London, the globe being rectified, London brought to the brass meridian, and the end of the quadrant of altitude laid to Rome, you will find the end fall against that part of the wooden horizon marked S.E., or south-east.

PROBLEM 7.—*To find the sun's longitude (or place in the ecliptic) for any given time.*

Find the day of the month on the wooden horizon, and opposite to it, in the adjoining circle, are the sign and degree of the ecliptic in which the sun is for that day; find the same sign and degree of the ecliptic on the globe, and that is the sun's place in the ecliptic.[b] Thus, on the 11th of May, the sun's place will be found to be in the 21st degree of Taurus.

PROBLEM 8.—*The day of the month being given, to find the sun's declination, and all those places where he will be vertical on that day.*

1. The sun's place in the ecliptic for the given day being brought to the meridian, the degree marked over it is the declination. 2. Turn the globe, and all the places which pass under that degree will have the sun

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[a] See Chapter IV., p. 46, for examples.

[b] This problem may likewise be performed on the celestial globe.

vertical on that day. Thus, on the 10th of May, the sun's declination will be found to be 17° 30′, and all those people who live under that parallel of north latitude have the sun in their zenith that day at noon.

PROBLEM 9.—*To find the sun's meridian altitude on a given day at any place.*

Rectify the globe for the latitude of the place; and find the sun's place in the ecliptic, and bring it to the brazen meridian. Then count the number of degrees on the meridian between the sun's place and the horizon, and you will have the altitude required.

CELESTIAL GLOBE.

PROBLEM 10.—*To find the declination of the sun or a star.*

Bring the sun or star to the brass meridian, and the degree over it is its declination. Thus, the sun's declination, June 21st, is 23½ degrees N.; and on the 21st of December, 23½ degrees S.

PROBLEM 11.—*To find the right ascension of the sun or a star.*

Bring the sun's place, or the star, to the brazen meridian, and the degree of the equinoctial cut by the meridian, is the right ascension. Thus, the sun's right ascension on the 21st of June, is 90°; and on the 21st of December, 270°.

PROBLEM 12.—*To find the latitude and longitude of a star.*

Put the centre of the quadrant of altitude on the pole of the ecliptic; and its graduated edge on the star; then the degree of the quadrant cut by the star is its latitude; and the degree of the ecliptic cut by the quadrant is its longitude.

PROBLEM 13.—*To find the time when any of the heavenly bodies rise, set, or come to the meridian.*

Rectify the globe to the latitude of the place; bring the sun's place in the ecliptic to the meridian, and set the index to XII. Then turn the globe till the given body comes to the eastern edge of the horizon, and the index will show the time of its rising. Bring the body to the meridian, and the index shows the time of its culmination or southing; then bring it to the western edge of the horizon, and the index will, in like manner, show the time of its setting.

PROBLEM 14.[a]—*To represent the face of the heavens at any given time and place, so as to point out all the constellations and remarkable stars there visible.*

Elevate the globe to the latitude of the place where you are, and set it due N. and S. Bring the sun's place in the ecliptic for the given day to the meridian, and set the index to XII. at noon; turn the globe westward, till the index points to the given hour; then the surface of the globe represents the exact face of the heavens at the given place.

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[a] If the globe be taken out into the open air, on a clear night, and set due N. and S., the relative situations of the constellations and the remarkable stars then visible, may easily be distinguished.

INTRODUCTION TO GEOGRAPHY.

COURSE FOR BEGINNERS.

[The preceding part of this work is intended for the use of TEACHERS and their MORE ADVANCED PUPILS. The part which follows may be divided into TWO COURSES, one for BEGINNERS, as the Preparatory Questions, Definitions, General Divisions, and those portions of the text which are printed in larger type; and the other, or SECOND COURSE, may embrace the remaining portions of the work.]

PREPARATORY QUESTIONS FOR YOUNG BEGINNERS.

WHERE do you live? In what direction is that from the school? Point in the direction of your house. Is it to the north, south, east, or west of this? Or does it lie in a direction between any two of these points? In what direction is the school from your house? What is the distance between your house and the school? How many furlongs in a mile? How many perches in a furlong? How many yards in a perch? How many feet in a yard? How many inches in a foot? Show on your finger the length of an inch. Is your foot twelve inches in length? Is mine? Why is it necessary to fix upon a definite measure?

What is the length of your ordinary steps or paces? How many of them would it take to make up a perch? A furlong? A mile? Could you tell the probable distance between your house and the school by the number of your steps? How could you ascertain it accurately? (By actual measurement.) Could you tell the probable distance between your house and the school by the time you require to walk it? At what rate do you walk at your usual gait? If you walk at the rate of two and a half miles an hour, and if it takes you half an hour to walk here every day, what is the probable distance between your house and the school?

How would you find short distances, such as the length or breadth of the school-room? (By actual measurement.) How longer distances, such as the length of a field, if accuracy not required? (By stepping it.) How long distances, as miles, if accuracy not required? (By the time.) Mention a place, village, or town, a mile from this? Two miles? Three? Four? Five, &c.? What is the direction of each of these places, villages, or towns from this? And what direction is the school from each of them?

What is a plain? Tell me where there is a plain? What may be its extent, that is, its probable length and breadth? What is a hill? What is a valley? Tell me where there is a hill? In what direction and distance is it from this? What is a mountain? Tell me the names of all the mountains you have seen? What is the height of the highest of those mountains? Could you measure the height of a mountain? (You are right; you could not, but you will soon learn.)

What is a river? Tell me where there is a river? In what direction does it flow? What is the breadth of it? How might you ascertain? Did you ever cross it? How? Will not the length of the bridge give you the breadth of the river, or nearly so? Where does the river in question rise? Do you know where it goes to? Does it empty itself into the sea, or into some other river, or into a lake? Do you know the length of this river, from its source to its mouth? Does it get larger as it proceeds? Why? What is a pond? What is a lake? Did you ever see a lake? Where? How far across it? How far around it? What is a sea? Did you ever see the sea? What sea was it?

What is a village? What is a town? What is a city? What is the name of the village you live in? How many houses do you think are in it? How many inhabitants? How are they employed? Name the principal trades and occupations of the people. Is this village noted for any thing? In what parish do you live? Name the adjoining parishes. In what county? Name the adjoining counties. Point in the direction of each. What is the name of the principal town in the county? In what direction is that town from this? Name some of the others, and point in the direction of each.

You live in the country: is the soil about your place fertile? Is the land well cultivated? What kinds of grain are raised by the farmers in your neighbourhood? What do they chiefly raise? To what markets do they send their produce? Do they rear cattle? Is the land in your neighbourhood better adapted for pasturage than for cultivation? Why? Are there any mines in your neighbourhood? What kind? How many men employed in each?

In what part or quarter of the heavens does the sun rise? In what direction from us is he in the middle of the day? In which quarter of the heavens does he set? In which quarter of the heavens is the sun never seen by us? Very well: now, recollect that these are called the EASTERN, SOUTHERN, WESTERN, and NORTHERN quarters of the heavens.[*]

What is the cause of the day? When, therefore, does the day begin, and when end? Is the length of the day always the same? When the sun is ten hours above our horizon, what is the length of the day? When the sun is ten hours below our horizon, what will be the length of the day? When are the days and nights equal? In which of the cardinal points of the horizon does the sun rise and set, when this is the case? How then may you know the east and west points of your horizon? But when is it mid-day? (When the sun has finished half of his daily course, that is, when he is *mid-way* between his rising and setting points; because it will take him as long time to descend to the western horizon from that point as he was in ascending to it from the eastern.)

When the sun is midway between his rising and setting points, (or, in other words, when he has attained his highest point of elevation in the heavens—or, which is the same thing, when he comes directly opposite to us in his daily course,) how much of the day has passed, and how much of it is to come? What hour by the clock corresponds to mid-day? How therefore may we, on any day of the year, ascertain when the sun is in his highest or MERIDIAN point of the heavens? (And as the sun is *south* of us in that position, we have only to carry our eye down in a right line from the sun to the earth to find the SOUTH point of our horizon; and having found it, we have all the other CARDINAL points; for the NORTH point is directly opposite to the SOUTH, and the other two points are midway between).[*]

Point to the north, south, east, and west sides of the school-room. In which side or wall is the door? The chimney? The windows? What are the dimensions of the school-room, that is, its length, breadth, and height? What do you suppose? Take this rule or tape and measure the length and breadth. (Suppose they find the room to be forty feet long by thirty broad.) Could you represent the length and breadth of the school-room on your slates? Do you not often see in pictures not half so large as the page of a book, representations of men, and houses, and trees? Well, reduce in the same way the dimensions of the school-room, or draw it, as it is said, *on a small scale.*[a]

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[*] Besides the four CARDINAL or chief points, NORTH, SOUTH, EAST, and WEST, there are four other important points with which the pupils should be made familiar, namely, the north-east, north-west, south-east, and south-west. The N.E. lies between the north and the east; the N.W. between the north and the west; the S.E. between the south and the east; and the S.W. between the south and the west. See note and illustration, page 166.

Suppose our scale to be *an inch* for every *ten feet*, what should be the length and breadth of the drawing on your slate? How many desks or benches in the school-room? Their length and breadth? If they are ten feet long each, and about a foot broad, what should be their length and breadth in the drawing? If there is a table in the room five feet by two and a half, what should be its dimensions in the drawing? Now complete the drawing. Describe it. (We have a *four-sided* figure on a *plane* surface, four inches long by three inches broad. This represents the length and breadth of the school-room on a scale of *an inch* for every *ten feet*. There are ten *broad* lines an inch long running across it, *parallel* to each other, to represent the benches. There is also a small four-sided figure *half* an inch long by a *quarter* of an inch broad to represent the table.) Very well: but there are other objects in the room, such as the chairs at the table. How would you represent them? (By putting them down in their relative positions, and in their relative dimensions.) What is the *scale* by which you are to measure all the objects in this drawing? Very well; now draw a line an inch long at the bottom of your slate to represent the scale. This line represents how many feet? The half of it represents? The quarter of it? The tenth part of it? Very well; if you divide it into ten equal parts, each part will represent a foot.

Could you make a *map?* No! Could you? You? You? *Why*, I have just seen each of you making *a map:* that drawing on your slates is a MAP of the school-room. A map represents a portion of the earth's surface, as it would appear to the eye of a spectator elevated at an immense distance above it. If you could look down upon the school (the roof and ceiling being removed) from a great height, as from a balloon, such is the appearance it would present to you. If viewed from a small elevation, as from a hole in the ceiling, would it not have a similar appearance? Would it appear so small? What effect has distance on the apparent magnitude or size of objects? The sun is many millions of times larger than the moon, and yet they appear to us to be nearly of the same size; how do you explain this?

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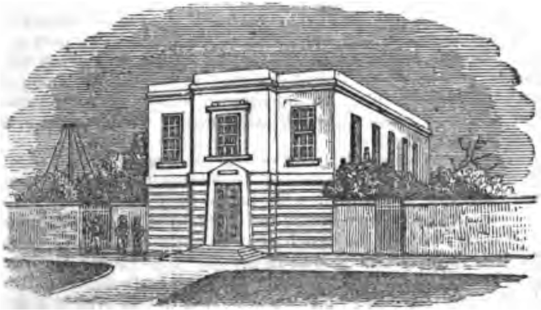
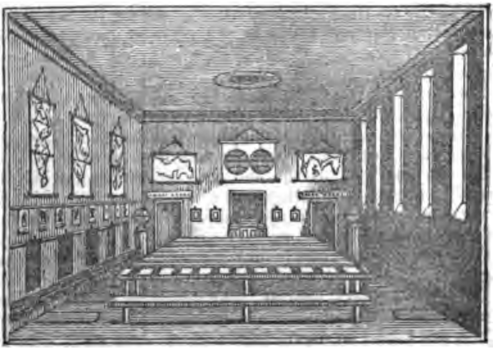
[a] SCALE properly means a *ladder;* and also a figure (so called from having some resemblance to a *ladder*) in maps exhibiting the proportions between the *represented* and *actual* distances. Hence the expressions "on a grand *scale;*" "on a small *scale*," &c. Hence SCALE to climb or ascend by *ladder*, as to *scale* the walls.



What is this? O, it is a picture of the school-house! And there are some of the boys going to school! And there is the play-ground, and the circular swing!

You are right; that is an exterior view or elevation, as it is called, of the school-house.

And what do you think this is?



O, it is a picture of the inside of the school!

You are right; this is an interior view of the school, as it would appear to a person looking in from the door. Now, take this sheet of paper which I have rolled up into the form of a tube, and look at the picture through it.

Well, how does it appear to you?

Though I know that every part of it is equally distant from me, yet this does not appear to be the case. The part opposite the eye seems to be the most remote, and every object appears to be in its relative place; just as the school-room, and the objects in it, would appear to my eye, if I stood at the door and looked in. Or as a street would appear to a person locking up it.

Very well, such a view is said to be *in perspective*.

But let us, for the information of other teachers and pupils who are not acquainted with our school, enumerate all the objects in the picture before us. In front of us are the benches and seats; and on the bench next us are several slates, which, though they look very well in the picture, should have been put into their proper places before the boys left their seats. Opposite to us is the master's seat or rostrum, which is raised on a platform, in order that he may be able to overlook the benches, and the whole school; and on the wall behind the rostrum is a large BLACK BOARD, for diagrams and demonstrations. On each side of the master's demonstration board are copies of the SCHOOL RULES, OCCUPATION OF TIME, PRACTICAL RULES FOR TEACHERS, and the GENERAL LESSON, which is, as you know, constantly inculcated on your minds, and which, I am sure, you have all off by heart.

The door on the right leads to the offices in the rear; and the door on the left leads to the class-room and the gallery, where SIMULTANEOUS instruction is given to the pupils in large divisions.

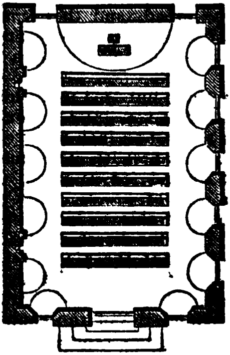
The maps on the walls speak for themselves; and those two round figures on the small pillars to the right and left of the platform, are the Terrestrial and Celestial Globes, which are always neatly covered when not required for use.

On the side wall to the left are large maps, which are let down by means of small pulleys, when lessons in geography are given; and under the maps are arranged pictures of animals and plants, or, as they are called, OBJECT LESSONS, which are, as you know, very interesting, and very instructing.

Under the object lessons, and opposite to the semicircles, round which the classes are formed, are the black boards, which are found so useful in teaching, and with which every school should be provided. On the front wall, as on the others, there are arranged in due order, maps, object lessons, and black boards; and in the centre of it, opposite to the master's seat, is the clock, by which the school business is regulated.

Now, let us take another, and different view of the school.

room. Suppose you were looking down from the ventilator, which is represented by those circular marks in the centre of the ceiling, what part of the school-room would be under your eye? Of course, the *ground* or floor, and all the objects on it, as the benches and seats. Exactly; and if a drawing of the school were made, as it would appear from this, we would have a GROUND-PLAN or MAP of the school-room.



Here is a ground-plan of the school-room; but it is on a much smaller scale than the interior view, which was made larger in order that the several objects in it might be more distinctly represented. The ground-plan is on a scale of twenty feet to an inch. Now, let us point out and measure the several objects represented in the ground-plan or *map* of the school-room.

Now could you extend your map so as to take in the garden and grounds adjoining the school-house? How could you map a piece of ground a hundred yards square? If on a scale of an inch for every ten yards, what should be the dimensions of your map? Now let us make a map of the ground about the school-house to this extent. First, we should make a square —of what dimensions? The top or upper side we should call the ——? The bottom or lower side the ——? The right hand side the ——? And the left hand side the ——? Now let us put marks to represent the different objects in it, as the school-house, the yard, the garden, &c. By what scale are these objects to be measured? Very well; draw a line in the corner of your map an inch long to represent the scale.

If you divide the scale into ten equal parts, each part will represent ——? With regard to the positions of the objects to be represented, how should they be placed? (According to their relative localities.) Where should we make a small square or oblong to represent the garden? Why? Now, let us point out the several objects represented in our map, and tell what direction they lie from each other, and why? Now, could you tell how we might make a map which would include the whole parish in which we live? Supposing it to be five miles long by three broad, and that you were required to draw it on a scale of an inch for every mile, how would you proceed? Now, how would you make a map of the county in which we live?

Ireland is about three hundred miles long by one hundred and seventy broad: could you draw on your slate a map to represent it? If on a scale of an inch for every fifty miles, what should be the length and breadth of the map?

Here is a map of Ireland (or England, or Scotland, as the case may be,) on a scale of ——. Let us place it upon the table, so that we may be able to look down upon it; and let us place the top of it in the direction of the *north* side of the school-room, in order that the places represented on it may appear in their relative positions. The outline or shape of the map represents the shape of the country; and these dotted lines represent the boundaries of the counties into which it is divided. These shaded lines represent the mountains, with the sides dark, and the tops light, just as they would appear to persons looking down upon them from a balloon. These crooked lines represent the rivers, and these double lines the roads. These dark spots represent the lakes; and these little circular spots the towns. Here is the county in which we live; and here is the spot we are in at this moment. Now let us trace the counties which *bound* or lie next ours on the north, south, east, and west; and let us find out the principal towns, and measure the distance between them on the scale of the map; and let us also state the direction in which they lie from each other.

PRELIMINARY DEFINITIONS.

GEOGRAPHY is a description of the EARTH.

The form or shape of the earth is nearly round or globular, and hence, it is called the GLOBE.

The CIRCUMFERENCE of the earth, or a circle round its thickest part, is nearly 25,000 miles.

The DIAMETER of the earth, or a straight line passing through its centre from side to side, is nearly 8,000 miles.

The AXIS of the earth is an imaginary line passing through its centre from north to south. The ends or extreme points of the earth's axis are called the POLES; the upper the *north* pole, and the lower the *south* pole.

The earth turns round its axis once in twenty-four hours producing DAY and NIGHT, alternately. This is called its DIURNAL motion. It also moves round the sun in the course of a year, producing the SEASONS in succession. This is called its ANNUAL motion.

The EQUATOR is a circle passing round the middle of the earth, at an *equal* distance from each pole. The equator divides the earth into two equal parts, which are called the northern and southern HEMISPHERES.[a]

LATITUDE is the distance of a place north or south from the equator.

PARALLELS OF LATITUDE are circles drawn round the globe *parallel* to the equator.

The most important parallels of latitude are the two TROPICS,[b] and the two POLAR[c] circles.

The tropics and the polar circles divide the globe into five ZONES or belts; namely, one *torrid*, two *temperate*, and two *frigid* zones.

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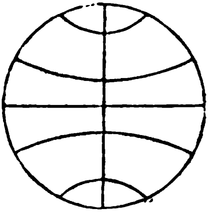
[a] That is *half spheres*, or, which is the same thing, half globes.

[b] The sun is never vertical or overhead to any place on the earth farther from the equator than 23½ degrees north and south, through which limits the tropics are supposed to be drawn; Cancer to the north, and Capricorn to the south. These parallels are called *tropics*, because when by the motion of the earth, the sun arrives at either of them, he *turns* back, as it were, towards the other. Before turning back, he apparently rests or attains the same elevation for two or three days. These periods are called the summer and winter SOLSTICES, that is, the *standing* or resting of the *sun*.

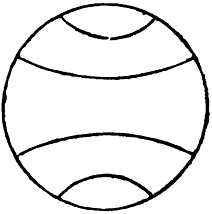
[c] When the sun is 23½ degrees south of the equator, that is, in the tropic of Capricorn, his rays fall short of the North Pole by the same number of degrees (23½). Through this point, a circle parallel to the equator, is supposed to be drawn, which is called the *Arctic* or North Polar Circle; and through the corresponding point in the southern hemisphere a similar circle is supposed to be drawn, which is called the *Antarctic* or South Polar Circle. The North Polar Circle is called *Arctic*, in allusion to its corresponding circle in the heavens, which passes through the constellation ARCTOS, or the Great *Bear*; and *Antarctic* means *opposite to* the Arctic.

The TORRID zone lies between the tropics; the TEMPERATE zones between the tropics and the polar circles: and the FRIGID zones between the polar circles and the poles.

CIRCLES.



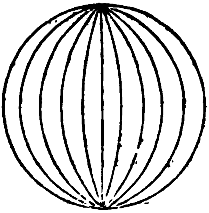
ZONES



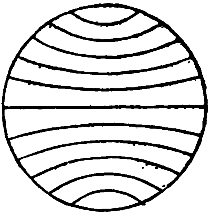
A MERIDIAN is a line running through any place north and south from pole to pole.[a]

The meridian which passes through Greenwich,[b] is called the FIRST MERIDIAN.

MERIDIANS.



PARALLELS.



LONGITUDE is the distance of a place east or west from the first meridian.

The circle which crosses the equator obliquely is called the ECLIPTIC. The ecliptic marks the line along which the sun's rays are vertical or overhead, in the course of the year.[c]

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[a] Such a line is evidently a *semicircle*, and if carried round the whole globe, a circle.

[b] In the vicinity of London, where the Royal Observatory is.

[c] The ecliptic properly refers to the heavens, and represents the circle which the sun, by the earth's annually revolving round it, seems to describe among the fixed stars in the course of the year. The sun is always in the ecliptic, and hence, when the moon comes in a line between us and the sun, his rays are partially *eclipsed* or obscured. This is called an *eclipse* of the sun, and it is from this circumstance that the sun's apparent path in the heavens is called the *ecliptic*.

The ZENITH is that point in the heavens which is directly over the head of the observer.

The NADIR is the point directly opposite to the zenith.

The SENSIBLE HORIZON is the circle bounding the view of the observer by the apparent meeting of the earth and sky.

The RATIONAL HORIZON[*] is a great circle whose PLANE passes through the centre of the earth *parallel* to the plane of the sensible horizon.

The PLANE of the sensible horizon is the level or *plain* surface on which the spectator stands.

The CARDINAL, or four principal points of the horizon, are the NORTH, SOUTH, EAST and WEST.

NATURAL DIVISIONS OF THE EARTH'S SURFACE.

The surface of the earth consists of land and water. The water covers more than two-thirds of the earth's surface.

The LAND is divided into continents, islands, peninsulas, capes and promontories, and isthmuses; and the WATER, into oceans, seas, gulfs, bays, channels, straits, and lakes.

DIVISIONS OF THE LAND.

A CONTINENT is a large extent of land *containing* several countries.

An ISLAND is a portion of land entirely surrounded with water.

A PENINSULA is a portion of land *almost* surrounded by water.

A CAPE or *head*-land runs out into the sea; and if elevated or *mountainous*, it is called a PROMONTORY.

An ISTHMUS is a narrow neck of land, connecting two larger portions together.

DIVISIONS OF THE WATER.

An OCEAN is a large extent of water, corresponding to a *continent*.

A SEA is smaller than an ocean, and is generally bounded or confined by land.

A GULF corresponds to a *peninsula*, and is almost surrounded by land.

A BAY has a wider opening than a gulf, and is, generally speaking, not so large.

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[*] The rational horizon is the circle which would bound our view if we could see the one-half of the globe. It is the circle which separates the visible hemisphere of the heavens from that which is not visible. The broad wooden circle on a terrestrial globe represents the rational horizon.

A STRAIT is a narrow passage of water connecting two seas. It corresponds to an *isthmus*.

A CHANNEL differs from a *strait*, in being much wider.

A CREEK is a narrow portion of water running up into the land.

A HARBOUR OF HAVEN is a part of the sea so nearly surrounded by land as to afford complete security for ships.

A ROAD affords safe anchorage near the land, with partial shelter.

A mouth of a river widening into the sea, is called an ESTUARY OF FRITH.

A LAKE is a portion of water entirely surrounded by land. It corresponds to an *island*.

An ARTIFICIAL GLOBE is a representation of the *form* of the earth, with its divisions into land and water.

A MAP is a representation of the earth, or of a part of it, on a *plane* surface.

The top of the map is the north; the bottom, the south; the right-hand side, the east; and the left-hand side, the west.[a] In a map of the world, longitude is marked on the equator, and latitude on the circles that contain the two hemispheres. But in maps of particular countries, longitude is marked at the top and bottom, and latitude at the sides. The lines running from the top to the bottom of the map, that is, *north* and *south*, are MERIDIANS; and the lines which run from one side of the map to the other, that is, *east* and *west*, are PARALLELS.

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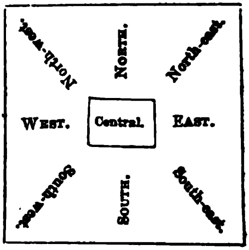
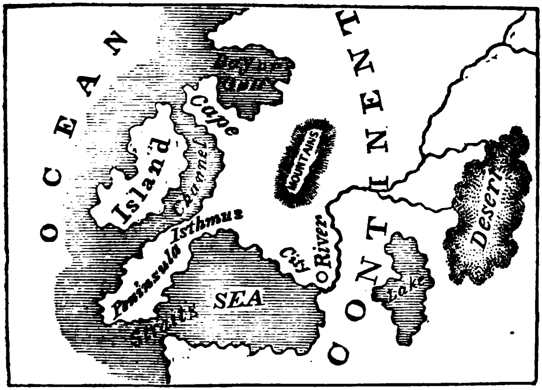
[a] In a map, the general direction of the principal points of the horizon may be represented thus:—



But before the pupils are introduced to a map, they should be quite familiar with the principal points of the horizon, as recommended page 119. And as a map is a picture of a portion of the earth's surface as it would appear to a person elevated at a great distance above it, when used for the first time, it should be laid upon the floor, or upon a table, with the *top* in the direction of the *north* side of the school-room. In this way, the learner will get a clear idea of what the map is intended to represent.

GEOGRAPHICAL TERMS ILLUSTRATED.



GRAND OR GENERAL DIVISIONS OF LAND AND WATER.

Of the land on the earth's surface there are FIVE GREAT DIVISIONS, namely, Europe, Asia, Africa, America, and Oceanica. Europe, Asia, and Africa, are sometimes called the Old World, and sometimes the Eastern Continent; while America is generally called the New World, or the Western Continent.

Of the water on the earth's surface there are also FIVE GREAT DIVISIONS, namely, the Pacific, the Atlantic, the Indian, the Arctic, and the Antarctic oceans.[a]

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[a] By looking on a map of the world, it will be evident that all these oceans communicate with each other, and that, strictly speaking, there is but one ocean or vast body of water which extends over more than two-thirds of the earth's surface. Of these great divisions of water the Pacific is the largest, being about 8,000 miles from north to south, and 11,000 from east to west. The Atlantic is next in extent, being about 9,000 miles from north to south, and where broadest, from east to west, between 3,000 and 4,000 miles. The Indian Ocean is about 7,000 miles from north to south, and about 5,000 miles from east to west.

The *Pacific* was so called, because it was erroneously supposed, when first discovered, to be free from storms. The *Atlantic* takes its name from Mount *Atlas* on the western coast of Africa; and the *Indian* Ocean, from *India* or *Hindostan*. The *Arctic* means the *north*, and the *Antarctic opposite* to the north. See note, page 163.

OCEANS.

The Pacific Ocean extends from the western shores of North and South America to the eastern coasts of Asia and Australia.

The Atlantic Ocean extends from the eastern shores of North and South America to the western coasts of Europe and Africa.

The Indian Ocean lies to the south of Asia, the east of Africa, and the west of New Holland.

The Arctic Ocean surrounds the north pole; and the Antarctic Ocean the south pole.

SUBDIVISIONS OF THE OCEANS.

Those parts of an ocean which approach or extend into the land are usually called seas, gulfs, bays, channels, or straits. Thus the Pacific Ocean, on its western side, forms the Sea of Kamtschatka, the Sea of Okhotsk, the Sea of Japan, the Yellow Sea, the Chinese Sea, the Gulf of Tonquin, and the Gulf of Siam; and on its eastern side, the Gulf of California, and the Bay of Panama.

The principal branches of the Atlantic Ocean on its eastern side are, the Baltic Sea, the North Sea or German Ocean, the Bay of Biscay, the Mediterranean Sea, and the Gulf of Guinea; and on its western side, Baffin's Bay, Davis' Strait, Hudson's Strait, Hudson's Bay, Straits of Florida, Gulf of Mexico, and the Caribbean Sea.

The principal branches of the Indian Ocean are, the Bay of Bengal, the Arabian Sea, the Persian Gulf, the Red Sea, and the Channel of Mozambique.

The principal branches of the Arctic Ocean are, the White Sea, the Sea of Kara, the Gulf of Obi, and Behring's Straits.

The Antarctic Ocean has no branches, because no part of it approaches any considerable tract of land.

CONTINENTS.

Four of the great divisions of land are called CONTINENTS, namely, Europe, Asia, Africa, and America. Continents are subdivided into COUNTRIES or NATIONS the inhabitants of which, generally speaking, differ in language laws, customs, and manners.

POLITICAL DIVISIONS.

The political divisions of the earth are *empires*, *kingdoms*, *duchies*, *principalities*, and *republics*; which contain *cities*, *towns*, and *villages*

An EMPIRE consists of several countries united under one monarch, who is generally called an *emperor*.[a]

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[a] The term *emperor* is derived from, and originally referred to the IMPERATOR of the Romans. The German emperors assumed the title as succes-

A KINGDOM consists of one or more countries, governed by a *king*.

A REPUBLIC is a country governed by rulers chosen by the *people*.

ESTIMATES OF THE EXTENT AND POPULATION OF THE EARTH.[a]

	Balbi, 1836.			Weimar Almanac, 1840.		
	Population.	Eng. square miles.	Pop. to sq. mile.	Population.	Eng. square miles.	Pop. to sq. mile.
Europe,	227,700,000	3,700,000	61	233,240,043	3,807,195	61
Asia,	390,000,000	16,045,000	24	608,516,019	17,805,146	34
Africa,	60,000,000	11,254,000	5	101,498,411	11,647,428	8
America,	39,000,000	14,730,000	2	48,007,150	13,542,400	3
Oceanica,	20,300,000	4,105,000	4	1,838,194	3,347,840	0
Totals,	737,000,000	49,834,000	15	993,099,817	50,150,009	20

Of the population of the globe about two-sixths are Christians, one-sixth Mahometans, and the remainder Pagans,[b] with the exception of between four and five millions of Jews.

The following ESTIMATES are from Malte Brun and Balbi.

Religions of the globe.	Malte Brun.	Balbi.
Christianity in all its branches,	228,000,000	260,000,000
Judaism, ...	5,000,000	4,000,000
Mahometanism, . . .	110,000,000	96,000,000
Brahmanism, . . .	60,000,000	60,000,000
Bhuddism, ...	150,000,000	170,000,000
Fetichism and other forms, .	100,000,000	147,000,000

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sors of Charlemagne, who was crowned Emperor of the West in the year 800; and the Czar (that is, the *Cæsar*) of Russia, and the Sultan of Constantinople, affect it as if succeeding to the Roman empire of the East. The term in itself implies greater power and more extensive sway than that of *king*, and hence it was assumed by Napoleon.

[a] Malte Brun's estimate of the population of the globe is lower than either of these, namely: Europe 170, Asia 320, Africa 70, America 45, and Oceanica 20 millions; in all, 625 millions. But it is obvious that all calculations on this subject are little more than conjectures. It is only with regard to Europe that they should be considered as approximating to the truth. As a medium, we may take 800 millions as the population of the globe. Refer to page 123 for an estimate of the extent of the globe, and of its great divisions.

[b] Of Paganism there are various systems, but they all resemble each other in their absurdity, idolatry, and immorality.

EUROPE.

EUROPE is the smallest, but by far the most important and the most powerful of the great divisions of the globe. For the grandeur of its natural features it is the least distinguished; but in knowledge, civilization, and refinement, it surpasses all the others.[a]

It is bounded on the north by the Arctic Ocean, on the east by Asia, on the west by the Atlantic Ocean, and on the south by the Mediterranean, the Archipelago, the Sea of Marmora, the Black Sea, and (according to some geographers) the Caucasian Mountains.[b]

Its length from the north-eastern extremity of Russia to Cape St. Vincent, in Portugal, is nearly 3,400 miles; and its breadth, from the North Cape, in Lapland, to Cape Matapan, in the Morea, is about 2,450 miles.

Europe lies between the parallels of 36° and 71° north latitude, and between about 10° W. and 63° E. longitude. The most southerly point of the continent is Punta de Tarifa[c] (36°) in the Strait of Gibraltar; the most northerly, Cape Nordkun[d] (71°) in Finmark; the most westerly, Cape Finisterre[e] (9° 27′) in Spain—or rather, Cape Roca, or the Rock of Lisbon (9° 28′); and the most easterly, is perhaps at the mouth of the Kara River[f] (66°)

The AREA or superficial extent of Europe may be estimated at upwards of 3½ millions of square miles English; and the POPULATION now exceeds 255 millions.[f]

GENERAL DIVISIONS OF EUROPE.

The *north* of Europe consists of Lapland, Finland, the northern parts of Russia, Norway, Sweden, and Denmark.

The *north-east* of Europe is occupied by Russia, and the *south-east* by Turkey and Greece.

The *middle* regions of Europe comprise Austria, the German

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[a] See page 107 for the distinguishing characteristics of the Caucasian or European race.

[b] The precise eastern boundaries of Europe are given differently by different writers. The following have been proposed by Malte Brun, as definite and natural: the Ural Mountains, the Ural River, and the Caspian Sea, as far as the Caucasian Mountains, which may be regarded as forming part of its southern boundary. The extent and population of Europe will, of course, vary according to the views taken of these boundaries.

[c] The latitude of Cape Matapan in the Morea, which is usually regarded as the most southerly point, is 36° 17′.

[d] *Cape Nordkun* is the most northerly point of the continent. The North Cape is on an island.

[e] *Finisterre*, that is, as is said in England, the *Land's End*.

[f] Refer to the preceding note on the boundaries of Europe.

States, Switzerland; and towards the coast, France, Belgium, Holland, Hanover, and Prussia.

The *south* of Europe consists of three great projections or peninsulas, which comprise Spain and Portugal, Italy, Greece and Turkey.

To the *west* of Europe, are the British Islands. Great Britain or England and Scotland, and Ireland.

The *northern* countries of Europe lie, generally speaking, north of the parallel of 55°; the *middle* countries, between 55° and 45°; and the *southern* countries, to the south of the parallel of 45°.

GENERAL TEMPERATURE.

The climate of the NORTHERN countries of Europe is *cold* towards the north, and *temperate* towards the south.

The climate of the MIDDLE countries is *temperate* towards the north, and *warm* towards the south.

The climate of the SOUTHERN countries is *warm* towards the north, and *hot* towards the south.

The PRODUCTIONS of the northern, middle, and southern countries of Europe vary with their CLIMATES. See page 253

POLITICAL DIVISIONS.

The present political divisions of Europe amount to 58, namely, 3 empires; 16 kingdoms; 1 ecclesiastical state; 7 grand duchies; 11 duchies; 12 principalities; 4 republics: and 4 free towns.

The EMPIRES are Russia, Austria, France, and Turkey.

The KINGDOMS are Great Britain and Ireland, Prussia, Spain, Sweden, and Norway, Holland, Belgium, Portugal, Naples and Sicily, Bavaria, Sardinia, Denmark, Saxony, Wurtemberg, Hanover, and Greece.

The GRAND DUCHIES are Baden, Hesse-Darmstadt, Mecklenburg-Schwerin, Mecklenburg-Strelitz, Oldenburgh, Saxe-Weimar, and Tuscany, to which the Duchy of Lucca has been recently ceded.

The principal DUCHIES are Nassau, Brunswick, Saxe-Coburg-Gotha,[a] Modena, and Parma, in Italy.

The REPUBLICS are, Switzerland, the Ionian Islands, San Marino, and Andorra (Pyrenees).

The FREE TOWNS are Hamburg, Frankfort, Bremen, and Lubeck.

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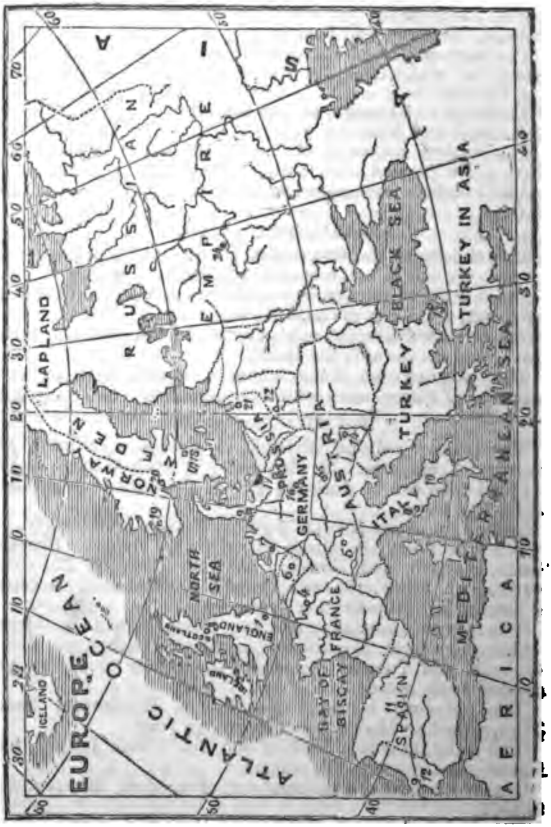
[a] The other DUCHIES are Anhalt-Bernburg, Anhalt-Cothen, Anhalt-Dessau, Saxe-Altenburg, Saxe-Meiningen; and the PRINCIPALITIES are Hesse-Cassel (Electorate), Schwartzburg-Sondershausen, Schwartzburg-Rudolstadt, Reuss, Elder and Younger Branch, Lippe-Detmold, Lippe-Schaumburg, Hohenzollern-Hechingen, Hohenzollern-Sigmaringen, Waldeck, Lichtenstein, and Hesse-Homburg (Landgrave of).



References to the Map of Europe.

Amsterdam,	**7**	**Christiania,**	**20**	**Hamburg,**	**9**	**Naples,**	**10**
Bergin,	**19**	**Constantinople,**	**13**	**Konigsberg,**	**21**	**Paris,**	**4**
Berlin,	**17**	**Cracow,**	**22**	**Lisbon,**	**12**	**Petersburg,**	**23**
Berne,	**5**	**Dresden,**	**16**	**London,**	**1**	**Rome,**	**8**
Brussels,	**6**	**Dublin,**	**2**	**Madrid,**	**11**	**Stockholm,**	**18**
Buda,	**14**	**Edinburgh,**	**3**	**Moscow,**	**24**	**Vienna,**	**15**

CAPITALS OF THE PRINCIPAL COUNTRIES IN EUROPE.

Countries.	Capitals.	Population.
England,	London,	2,362,236
Ireland,	Dublin,	258,361
Scotland,	Edinburgh,	160,302
Denmark,	Copenhagen,	130,000
Norway,	Christiania,	33,000
Sweden,	Stockholm,	95,000
Russia,	St. Petersburgh,	500,000
Poland,	Warsaw,	155,000
Prussia,	Berlin,	400,000
Austria,	Vienna,	410,000
Germanic Confederation,	Frankfort,	75,000
Holland,	Amsterdam,	220,000
Belgium,	Brussels,	140,000
France,	Paris,	1,200,000
Switzerland,	Berne,	25,000
Spain,	Madrid,	220,000
Portugal,	Lisbon,	280,000
Italy,	Rome,	170,000
Turkey,	Constantinople,	600,000
Greece,	Athens,	27,000

CLASSIFICATION OF THE STATES OF EUROPE.

Great Britain, France, Russia, Austria, and Prussia, are called "the Five Great Powers of Europe."

Spain, Sweden, and Turkey, are second-rate powers.

Holland, Belgium, Portugal, Naples, Bavaria, Sardinia, Denmark, Saxony, Wurtemberg, Hanover, and Switzerland, are third-rate powers; and the remainder are fourth-rate, or under.

RELIGIONS OF EUROPE.

Generally speaking, the Roman Catholic religion prevails in the south of Europe, the Protestant in the north, and the Greek Church in the north-east. In the middle countries of Europe there is a mixture of Protestants and Roman Catholics, as in the German States, &c. Mohammedanism is confined to Turkey and the extreme south of Russia.[a]

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[a] In the *Weimar Almanac* for 1836, the POPULATION and RELIGIONS of Europe are given as follows:—(See page 169.)

Christians,	Roman Catholics,	121,743,000
	Protestants	52,340,000
	Greek Church,	43,300,000
Mohammedans,		8,050,000
Jews,		1,752,000
Other faiths,		815,000
	Total	228,000,000

SEAS, GULFS, BAYS, AND STRAITS.

SEAS.—The principal seas of Europe are the Mediterranean, the Baltic, the North Sea or German Ocean, the White Sea, the Black Sea, the Archipelago, the Sea of Marmora, the Sea of Azof, the Irish Sea, the Skager Rack, and the Cattegat.

GULFS.—The Gulf of Venice, Genoa, Lyons, Taranto, and Lepanto, in the Mediterranean; and the Gulf of Bothnia, Finland, and Riga, in the Baltic.

BAYS.—The Bay of Biscay, north of Spain.

CHANNELS.—The British Channel, St. George's Channel, the North Channel (north of the Irish Sea.)

STRAITS.—The Straits of Gibraltar, Bonifacio, and Messina, in the Mediterranean; the Straits of the Dardanelles, and Constantinople, connecting the Sea of Marmora with the Archipelago and Black Sea; the Straits of Kaffa or Enikale, between the Black Sea and the Sea of Azof; the Straits of Dover; the Sound, and the Great and Little Belts which connect the Baltic with the Cattegat.

ISLANDS.—The principal islands of Europe are, Great Britain and Ireland; Sicily, Sardinia, Corsica, Elba, Majorca, Minorca, Iviza, Malta, and the Ionian Islands, in the Mediterranean; Negropont, and many others, in the Archipelago; Candia and Cyprus in the Levant Sea; the Azores in the Atlantic Ocean; Zealand, Funen, Gothland, &c., in the Baltic; Guernsey, Jersey, &c., in the British Channel the Isle of Man; the Orkney and Shetland Isles; Iceland, Spitzbergen, and Nova Zembla.

PENINSULAS.—Spain and Portugal, called, by way of eminence, the Peninsula; Italy, the Morea, Jutland, the Crimea, &c.

ISTHMUSES.—The Isthmus of Corinth in Greece; and Perekop, which connects the Crimea with the mainland.

CAPES.—The North Cape in Lapland; the Naze, south of Norway; Cape Finisterre and Ortegal in Spain; Cape La Hogue in France; Cape St. Vincent in Portugal; Cape Spartivento in Italy; Cape Matapan in the Morea; Cape Clear in Ireland; and the Land's End in England.

MOUNTAINS.—The principal mountains in Europe are, the Alps, which divide Italy from Switzerland, Germany, and France; the Pyrenees, between France and Spain; the Apennines, which run down Italy; the Carpathian, north and north-east of Hungary; Haemus or the Balkan Mountains, in Turkey; the Ural or Uralian, between Europe and Asia; and the Dofrine or Dofrefeld, between Norway and Sweden. The volcanoes or burning mountains are, Etna in Sicily, Hecla in Iceland, and Vesuvius in Italy.

RIVERS.—The principal rivers of Europe are the Volga, flowing into the Caspian Sea; the Danube, Dnieper, and Dniester, into the Black Sea; the Don, into the Sea of Azof: the Rhine and the Elbe, into the North Sea; the N. Dwina, into the White Sea; the Vistula, Oder, and S. Dwina, into the Baltic; the Rhone, Loire, Garonne, and Seine, in France; the Tagus, Guadiana, and Ebro, in Spain; the Po and Tiber, in Italy; the Thames and Severn, in England; the Shannon, in Ireland; and the Tay and Clyde, in Scotland.

LAKES.—The principal lakes are, Ladoga and Onega in Russia; Wener, Wetter, Maeler, in Sweden; Geneva, Constance, and Neufchatel, in Switzerland; Garda, Como, and Maggiore, in Italy; Lough Neagh in Ireland; Loch Lomond in Scotland; and Windermere in England.

PHYSICAL OR NATURAL FEATURES OF EUROPE.

Europe is distinguished from all the other great divisions of the globe by the irregularity of its shape or outline, and the consequent indentation of its coasts by seas, gulfs, and harbours. With the exception of Switzerland and the Minor German states, every country in it has the advantage of a sea coast. This circumstance not only gives Europe peculiar facilities for commerce and navigation, but has also a beneficial effect upon its climate and natural products.

SURFACE.—About two-thirds of the surface of Europe consist of an immense plain with occasional elevations. The remainder is mountainous or hilly. The principal mountain ranges, with the exception of the Scandinavian chain, are in the south. [Refer for examples to Chapter VI. See also page 125, for a general view of the declivities and drainage of Europe, &c.]

CLIMATE.—Europe, with the exception of a small portion of its northern extremity, lies within the temperate zone, and is therefore not exposed to the extremes either of heat or cold. Its climate is therefore more agreeable, and better adapted to develop the physical and intellectual energies of man, than that of any of the other great divisions of the globe. Its climate is also improved by the great number of its seas,[*] gulfs, and bays; and by the absence of those circumstances which render America and Asia so much colder in the same latitude. [Refer to Chapter V., p. 52, for examples.]

MINERAL PRODUCTIONS.—Europe produces, in great abundance, iron, lead, copper, tin, quicksilver, coal, and salt,—minerals far more useful to man, and much more productive of wealth, than gold, silver, and precious stones. Nor is it greatly deficient in its supply of the precious metals. The gold which it produces is equal to the amount now supplied by America. Of the whole quantity of gold produced in Europe, Russia, which also produces *platina* and *precious stones*, supplies six-sevenths, and Hungary and Transylvania nearly the remaining seventh.

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[*] See note, page 103, and second paragraph, p. 82.

Austria and Saxony produce a few *precious stones*, and *silver* in small quantities. *Silver* is also produced in small quantities in Hanover, Turkey, Prussia, England, France, &c.

Of the whole quantity of iron produced in Europe, England furnishes a third; Russia, a fourth; France, a fifth; and Sweden, a tenth. The Swedish and Russian iron is very superior in quality, and well adapted for the fabrication of steel. The iron for ordinary purposes in England is of an inferior description,[a] but the best English iron is nearly equal in value to the finest Swedish. Of the value of the whole mineral produce of Europe, iron, notwithstanding the slight intrinsic value of the metal, constitutes a third; while gold, silver, and platina, taken together, constitute only a ninth of that value.

Of the *lead* produced in Europe, Spain supplies nearly the one-half, and England three-sevenths.

Of the *tin*, England supplies about twelve-thirteenths, that is, nearly the whole;[b] and of the *copper*, more than the half. Of the remainder, Russia supplies a fifth, and Sweden and Norway a tenth.

Of the *coal*, England produces ten times as much as France, and nearly seven times as much as either Belgium or Prussia.

Quicksilver is found principally in the mines of Idria, in the Austrian empire. It is also found in Spain and Bavaria.

Platina has been recently discovered in the Ural and Caucasian mountains.

Zinc, *cobalt*, *arsenic*, and nearly all the other minerals with which we are acquainted, are found within the limits of Europe.

Northern Italy yields the finest *statuary marble;* and the south part of the same country, and Sicily, supply immense quantities of *sulphur*, *vitriol*, *sal-ammoniac*, and other volcanic products.

Nitre is found in great quantities in Hungary; and *salt* in almost every country in Europe. The salt mines of Wielitzka, near Cracow, are the most celebrated.

VEGETABLE PRODUCTS.—Refer to page 287, for general views on this subject.

ANIMALS.

QUADRUPEDS.—The number of wild animals in Europe is nothing when compared with those inhabiting the other great divisions of the globe, particularly Asia and Africa. The most formidable are the white bear, confined to the frozen regions, the brown bear, once common in England, but now found only in the Alps, Pyrenees, and other remote mountainous and wooded regions; the wolf, still inhabiting many parts of Europe, and the wild boar. Of the deer species, the elk and reindeer are found in the extreme north of Europe; and in some of the central countries, the red-deer, and roebuck. In the Alpine regions, in the south, are found the chamois or wild goat, and the ibex. The other wild animals are the lynx, confined to the south of Europe; the wild cat, the fox, the otter, &c.

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[a] The British foundries produce five-sixths of the cast-iron consumed in Europe for the fabrication of machinery, culinary utensils, &c., the French about a tenth, and the Prussian scarce a fortieth. In Russia and Sweden few castings are made.

[b] The tin mines of England (in Cornwall), are as famed for their richness as for their great antiquity.—See page 201.

BIRDS.—The birds of Europe are much more numerous than the *mammalia*. Above 400 species are regular inhabitants, besides many occasional visitants. The northern regions are characterized by the multitudes of swimming and wading birds; and in the mountainous and rocky parts of those regions, there are also enormous eagles, large owls, and other birds of prey.

In the central and southern regions are found the golden and imperial eagles; and four species of vultures inhabit the Alpine ranges.

On the shores of the Mediterranean there is an intermixture of the ornithology of Europe, Africa, and Asia; as the Balearic crane, pelican, flamingo, &c. The birds of Europe are not so distinguished by the brilliancy of their plumage as those of the tropical regions, but they excel them in the melody of their notes.

FISH.—In the northern seas, the whale, walrus, &c.; in the Mediterranean, the anchovy and tunny; in almost all the other seas of Europe, herring, salmon, cod, ling, haddock, &c. &c.

REPTILES.—The reptiles of Europe are few, and generally harmless. The common viper is the only venomous serpent.

RACES OF MEN.—The different races of men in Europe, as indicated by their languages, are the Celtic, the Gothic or Teutonic, the Græco-Latin, the Slavonic, the Ouralian or Finnish, and the Turkish or Tartar. Many of these races have more or less amalgamated, and their languages have been intermixed.

GOVERNMENT.—The despotism of Asia and Africa is unknown in Europe, for even in those states which are under absolute monarchies,[a] the sovereigns are restricted by the laws, usages, and institutions of their respective countries.

Under a *limited* or *constitutional* monarchy the subject enjoys the highest degree of rational liberty: and of this form of government the United Kingdom of Great Britain and Ireland affords the most perfect[b] specimen.

The other countries in Europe under *limited* or constitutional monarchies, are Sweden, Norway, Denmark, France, Holland, Belgium, Hanover, Bavaria, Wurtemberg, Spain, Portugal, and Greece.

The countries under *absolute* monarchies are Turkey, Russia, and, in a less degree, Prussia, Austria, Italy, Sardinia, and some of the Minor German states.

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[a] An *absolute* monarchy is a government where the legislative and executive functions are administered by the sovereign without his being subject to the control of any legally constituted or representative public body, such as a *parliament*. In no country in Europe, not even in Turkey, is there a really absolute monarch, that is, where the sovereign can say with safety,—

"Sic volo, sic jubeo, stet pro ratione voluntas."

[b] The most distinguished foreign writers on the subject of civil government, including *Montesquieu* and *De Lolme*, have given it as their opinions, that in no part of the world is liberty so well understood, and so pefectly enjoyed, as under the British constitution.

The *republican* form of government prevails only in Switzerland, the Free Towns (Hamburg, Frankfort, Bremen, and Lubeck), and in the small states of the Ionian Islands, San Marino, and Andorra.

EXTENT AND POPULATION OF THE SOVEREIGN STATES OF EUROPE.

Sovereign States.	Area in square miles, English.	Year of census.	Population.	Population to sq. mile.
Russia (in Europe),	2,000,000	1846	54,092,300	27
Austria,	257,368	1846	37,583.755	145
France (including Corsica),	203,736	1851	35,781,628	138
Great Britain and Ireland,	122,823	1851	27,619,866	224
Prussia,	107,921	1849	16,346.625	151
Spain,	182,270	1849	14,216,219	78
Turkey (in Europe),	210,585	1844	15,500,000	73
Sweden and Norway,	291,164	1845	4,645,007	16
Holland,	13,598	1851	3,267,638	240
Belgium,	11,313	1849	4,359,090	385
Portugal,	36,510	1841	3,412,500	96
Denmark,	21,856	1850	2,364,597	108
Bavaria,	29,638	1849	4,519.546	152
Hanover,	14,776	1848	1,758,847	119
Wurtemberg,	7,675	1850	1,802,252	235
Saxony,	5,766	1849	1,894,431	328
Baden,	5,851	1849	1,362,774	250
Brunswick,	1,524	1846	268,943	110
Hesse-Cassel (Electorate),	3,858	1846	754,590	195
Hesse-Darmstadt,	3,243	1849	852,524	262
Mecklenburg-Schwerin,	4,834	1851	543,328	112
Oldenburg,	2,417	1850	278,030	115
Nassau,	1,802	1851	428,218	237
Saxe-Weimar,	1,421	1851	261,370	184
Saxe-Coburg-Gotha,	816	1849	149,753	171
Other German States,	7,000	1849	1,350,000	193
Naples and Sicily,	42,132	1845	8,325,316	197
Sardinian States,	29,130	1848	4,916,084	169
Papal States,	17,210	1843	2,898,115	168
Tuscany and Lucca,	8,553	1851	1,761,140	206
Parma,	2,268	1851	497,343	2 4
Modena,	2,092	1851	586,458	280
San Marino,	22	1837	8,000	364
Swiss Confederation,	14,950	1851	2,390,116	159
Greece,	15,200	1851	998.266	65
Ionian Islands (republic),	1,100	1852	230,000	209
Cracow,*	488	1837	131,462	269
Andorra (republic),	200	1837	15,000	75
Total,	3,689,616		258,399,669	70

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* *Cracow.*—The republic of Cracow was recently (1846) broken up and taken possession of by Austria. In this spoliation Russia and Prussia concurred.

THE BRITISH EMPIRE.

The **British Empire** consists of the United Kingdom of Great Britain and Ireland, and of extensive possessions and numerous colonies in every quarter of the world.

The island of Great Britain comprises England and Wales, or South Britain; and Scotland, or North Britain. Ireland lies to the west of Great Britain, and is sometimes called West Britain. Great Britain and Ireland, with the adjacent islands, are usually called the British Isles.

The British possessions are:—

In Europe—Heligoland, a small island in the German Ocean, about twenty-six miles from the mouths of the Elbe and Weser; Gibraltar, an important fortress in the south of Spain, commanding the entrance to the Mediterranean; Malta, an important and celebrated island in the Mediterranean, to the south of Sicily; and the Ionian Islands, to the west of Greece, which form a republic under the protection of the British crown.

In Asia—The greater part of India or Hindostan; Aracan, a large territory, extending along the western coast of the Eastern Peninsula, formerly belonging to the Burmese, but ceded by them to the British in 1826; Ceylon, a large and important island, near the south-eastern extremity of Hindostan; Malacca, a settlement on the west coast of the Malay peninsula; Prince of Wales' Island, near the west coast of Malacca; Sincapore, an island at the southern extremity of the same peninsula; and the Island of Hong Kong, lately ceded to us by the Chinese.

In Australia—The greater part of the vast island of New Holland; Van Diemen's Land; New Zealand; and Norfolk Island.

In Africa—The important and flourishing colony of the Cape of Good Hope, Sierra Leone, and several other settlements and forts on the western coast; and the islands of Fernando Po, St. Helena, Ascension, and the Mauritius or Isle of France.

In North America—Labrador, the countries around Hudson's Bay, Upper and Lower Canada, New Brunswick, Nova Scotia, Newfoundland. Prince Edward's Island, Cape Breton the Bermudas or Somer's Islands; Balize, and other settlements in the Bay of Honduras.

In South America—The settlements of Demerara, Essequibo, and Berbice, in Guiana; and the Falkland Islands.

In the West Indies—The Lucayos or Bahama Islands Jamaica, Barbadoes, Trinidad, and several other important islands.

The *area* of the United Kingdom of Great Britain and Ireland may be estimated at about 120,000 square miles; and the *population* at about 27½ millions.

It has been estimated that Great Britain rules over an extent of territory *fifty* times as large as itself, and over a population more than *five* times as numerous as its own. In fact the sun never sets upon the British dominions.

The army,[a] exclusive of the native Indian troops, amounts to upwards of 100,000 men; and the navy[a] consists of above 500 ships of war, more than a hundred of which carry from 72 to 120 guns each. The number of vessels engaged in British trade is about 30,000; and the number of seamen employed in them is upwards of 180,000.

The annual REVENUE of Great Britain and Ireland amounts to about £50,000,000; that is, nearly equal to a third of the sum total of the revenues of all the states of Europe.

The NATIONAL DEBT amounts to nearly £800,000,000; that is, to more than half of the sum total of the debts of all the states of Europe. But the national PROPERTY exceeds, it is estimated, £3,700,000,000; and if colonial property be included, £5,500,000,000. The national INCOME, or the produce from all kinds of industry and property, is valued at upwards of £500,000,000 a year.

EXTENT AND POPULATION OF THE BRITISH EMPIRE.

BRITISH ISLANDS.	Extent in square miles.	Population.			
		1821.	1831.	1841.	1851.
GREAT BRITAIN:					
England, -	50,387	11,261,437	13,091,005	14,995,138	16,733,947
Wales, - -	7,425	717,438	806,182	911,603	1,188,821
Scotland, -	32,167	2,093,456	2,365,114	2,620,184	2,870,784
IRELAND, - -	32,512	6,801,827	7,767,401	8,175,124	6,515,794
Isle of Man, -	220	40,081	41,000	47,975	52,116
Guernsey, &c.,	50	20,827	26,128	28,521	33,645
Jersey - -	62	28,600	36,582	47,544	57,155
ARMY, NAVY, &c.		319,300	277,017	*188,453	*167,604
Total of United Kingdom,	122,823	21,282,966	24,410,429	27,019,558	27,614,866

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[a] The British army, during the Revolutionary wars, amounted to upwards of 350,000 men, including militia and volunteers; and the navy to more than 1,100 ships, of which 256 were ships of the line; and the number of seamen to about 140,000. Steam-ships and frigates now form a considerable portion of the navy.

* Such part of the Army, Navy, and Merchant Seamen, as were on shore within the United Kingdom, on the night when the census was taken, are included in this enumeration.

Colonies and Foreign Possessions.		Estimate of the extent in sq. miles.	Estimate of the Population.
In Europe,	Gibraltar, Malta, Gozo, Heligoland,	130	150,000
Asia,	Presidencies of Bengal, Madras, and Bombay,	645,000	100,000,000
	Scinde and the Punjaub,	150,000	4,000,000
	The Island of Ceylon,	25,000	1,500,000
	Assam, Aracan, the Tenasserim Provinces, &c.,	100,000	1,250,000
	Forts and Settlements, comprising Aden, Malacca, Pulo-Penang, Singapore, Hong Kong, Labuan, &c.,	2,000	250,000
Africa,	Cape Colony,	120,000	261,436
	Port Natal,	18,000	—
	Sierra Leone, Gambia, Gold Coast, and Cape Coast Castle,	2,000	325,323
	The Mauritius, St. Helena, Ascension, Roderigue, and Seychelle Islands,	1,000	187,706
N. America,	Upper Canada,	100,000	723,292
	Lower Canada,	250,000	768,334
	New Brunswick,	27,700	156,162
	Nova Scotia, and Cape Breton,	18,700	199,906
	Newfoundland,	36,000	96,506
	Prince Edward's Island,	2,200	62,678
	Hudson's Bay Territory, Oregon, and Vancouver's Island,	1,000,000	100,000
C. America,	Honduras,	62,055	11,066
	British West India Islands,	15,000	805,106
S. America,	Guiana, comprising Demerara, Essequibo, and Berbice,	98,889	126,000
	Falkland Islands,	2,500	270
Australasia,	N. S. Wales, South Australia, Western Australia, Van Diemen's Land, New Zealand, Norfolk Island,	2,500,000	1,000,000
TRIBUTARY AND PROTECTED STATES.			
In Europe, the Ionian Islands,		1,100	230,000
India, Berar, Oude, Mysore, Cochin, and the dominions of the Nizam, &c.		500,000	40,000,000
Total of the British Empire, in round numbers,		5,500,000	180,000,000

ENGLAND AND WALES.

England is bounded on the north by the river Tweed, the Cheviot Hills, and the Solway Frith, which divide it from Scotland; on the south by the English or British Channel; on the east by the German Ocean; and on the west by St. George's Channel and the Irish Sea.

It lies nearly between the parallels of 50° and 56° north latitude, and between about two degrees of east, and six of west longitude.[a] Its length from the coast of Dorsetshire to Berwick-on-Tweed, is about 360 miles; and its breadth from St

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[a] Accurately, between 1° 46′ east, and 5° 41′ west longitude.

David's Head, in Pembrokeshire, to Lowestoff, in Suffolk, is about 300 miles. Its AREA is estimated at 57,812 square miles, or 37,094,400 acres. The POPULATION of England and Wales, according to the late returns,[a] amounts to 17,922,768, or nearly eighteen millions.

The population of England alone is 16,733,947, or nearly sixteen millions and three quarters; and the population of Wales, 1,188,821, or nearly one million and a quarter.

England is divided into forty COUNTIES or SHIRES, and Wales into twelve, which, with the principal towns, are as follow:—

SIX NORTHERN COUNTIES OF ENGLAND.

Counties.	*Principal Towns.*
Northumberland,[b]	Newcastle, Berwick, Alnwick.
Cumberland,	Carlisle, Whitehaven, Penrith.
Westmoreland,[c]	Appleby, Kendal.
Durham,	Durham, Sunderland, Stockton.
Yorkshire,	York, Leeds, Sheffield, Hull.
Lancashire,	Liverpool, Manchester, Lancaster.
	FOUR ADJOINING WALES.
Cheshire,[d]	Chester, Stockport, Macclesfield.
Shropshire,	Shrewsbury, Ludlow, Bridgenorth.
Herefordshire,	Hereford, Leominster, Ledbury.
Monmouthshire,	Monmouth, Chepstow, Abergavenny.
	TEN NORTH MIDLAND.
Nottinghamshire,	Nottingham, Newark, Mansfield.
Derbyshire,	Derby, Chesterfield, Ashbourne.
Staffordshire,	Stafford, Lichfield, Wolverhampton.
Worcestershire,	Worcester, Dudley, Kidderminster.
Warwickshire,[e]	Birmingham, Warwick, Coventry.
Leicestershire,	Leicester, Loughborough.
Rutlandshire,[f]	Oakham, Uppingham.
Northamptonshire,	Northampton, Peterborough.
Huntingdonshire,	Huntingdon, St. Ives, St. Neot's.
Cambridgeshire,	Cambridge, Ely, Newmarket.

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[a] The last census (1851) exhibits an increase of about 12 per cent. for England, and 10 for Wales and Scotland; but a *decrease* for Ireland of nearly 20 per cent.

[b] Northumberland, that is, *the land north of the Humber*. The kingdom of Northumberland, during the Heptarchy, extended from the Humber to the Frith of Forth.

[c] Westmoreland, that is, the *west moorland*.

[d] Cheshire for *Chester*shire. *Chester* derives its name from the Latin term *castra*, an encampment or fortified place. Hence also the frequent terminations in English towns; as in *Doncaster*, that is, the fortification on the *Don*, *Colchester*, on the *Colne; Lancaster*, on the *Lune; Exeter* (for *Execester*, on the *Exe; Rochester*, on the rock (*roche*).

[e] Warwick, that is, the *town* where the munitions for *war* were kept; the termination *wick* being from the Latin *vicus*, a street or town. Hence Nor*wick*, the *north town*, Green*wich*, Sand*wich*, Middle*wick*, Aln*wick*, &c.

[f] Rutland, that is, *red land*, for which this shire is still noted.

TEN SOUTH-MIDLAND.

Counties.	*Principal Towns.*
Gloucestershire,	Bristol, Cheltenham, Gloucester.
Oxfordshire,	Oxford, Woodstock, Henly, Banbury.
Buckinghamshire,	Aylesbury, Buckingham, Wycombe.
Bedfordshire,	Biggleswade, Bedford, Dunstable.
Hertfordshire,	Hertford, St. Albans, Ware.
Middlesex,[a]	London, Westminster, Uxbridge.
Surrey,	Southwark, Guildford, Kingston.
Berkshire,	Reading, Windsor, Abingdon.
Wiltshire,	Salisbury, Devizes, Marlborough.
Somersetshire,	Bath, Taunton, Bridgewater.

FOUR EASTERN.

Lincolnshire,	Boston, Lincoln, Stamford.
Norfolk,[b]	Norwich, Yarmouth, Lynn.
Suffolk,	Ipswich, Bury St. Edmond's, Sudbury.
Essex,	Colchester, Chelmsford, Harwich.

SIX SOUTHERN.

Kent,	Canterbury, Maidstone, Dover.
Sussex,	Chichester, Brighton, Lewes.
Hampshire,	Portsmouth, Winchester, Southampton.
Dorsetshire.	Dorchester, Weymouth, Poole.
Devonshire,	Exeter, Plymouth, Devonport.
Cornwall,	Launceston, Falmouth, Truro.

THE COUNTIES OF WALES.

SIX IN NORTH WALES.

Flintshire,	Holywell, Mold, St. Asaph.
Denbighshire,	Wrexham, Denbigh, Ruthin.
Caernarvonshire,	Caernarvon, Bangor, Conway.
Anglesey,	Beaumaris, Holyhead.
Merionethshire,	Dolgelly, Bala.
Montgomeryshire,	Welshpool, Montgomery, Newton.

SIX IN SOUTH WALES.

Radnorshire,	New Radnor, Presteigne.
Cardiganshire,	Cardigan, Aberystwith.
Pembrokeshire,	Pembroke, Haverfordwest, Milford.
Caermarthenshire,	Caermarthen, Llanelly.
Brecknockshire,	Brecknock or Brecon, Hay.
Glamorganshire,	Cardiff, Swansea, Llandaff.

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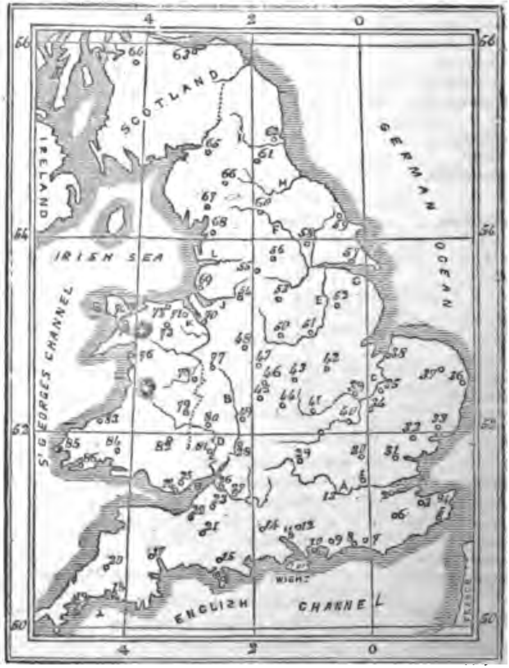
[a] Middlesex, that is, *middle Saxons*, with reference to ESSEX, or *East Saxons;* SUSSEX, or *South Saxons;* and WESSEX, or *West Saxons.* *Wessex,* the name of which no longer remains, though the most powerful kingdom of the heptarchy, comprised the counties to the *west* of Middlesex and Sussex, namely, Hampshire, Berkshire, Dorsetshire, &c.

[b] Norfolk, that is, the *north folk* or people, with reference to *Suffolk*, which means the *south folk.* *Folk* is evidently from (*vulg.*) *vulgus*, the Latin word for the *people*.

ENGLAND AND WALES.



References to the Map of England and Wales.

Appleby,	66	Caermarthen,	84	Exeter,	17
Bath,	27	Caernarvon,	75	Falmouth,	19
Beaumaris,	74	Chatham,	2	Flint,	71
Bedford,	40	Chelmsford,	31	Gloucester,	28
Birmingham,	46	Chester,	70	Harlech,	76
Brecon,	82	Chichester,	9	Halifax,	55
Bridgewater,	22	Colchester,	32	Hereford,	80
Brighton,	8	Coventry,	44	Hertford,	30
Bristol,	26	Denbigh,	73	Hull,	57
Cambridge,	34	Derby,	50	Huntingdon,	3.
Canterbury,	3	Dorchester,	15	Ipswich,	33
Cardiff,	24	Dover,	5	Kendal,	67
Cardigan,	83	Durham,	61	Lancaster,	68
Carlisle,	65	Ely,	35	Launceston,	20

Landaff,	25	Newcastle,	62	Salisbury,	14
Leeds,	56	Northampton,	41	Scarborough,	59
Leicester,	43	Nottingham,	51	Sheffield,	53
Lewes,	7	Norwich,	37	Shrewsbury,	77
Lichfield,	47	Oakham,	42	Southampton,	11
Lincoln,	52	Oxford,	29	Stafford,	48
Liverpool,	69	Pembroke,	86	Taunton,	21
London,	1	Plymouth,	18	Warwick,	45
Lynn,	38	Portsmouth,	10	Wells,	23
Maidstone,	6	Radnor,	79	Weymouth,	16
Manchester,	54	Reading,	13	Winchester,	12
Margate,	4	Ripon,	60	Worcester,	49
Monmouth,	81	St. Asaph,	72	Yarmouth,	36
Montgomery,	78	St. David's,	85	York,	58

RIVERS.

A A Thames.	C Great Ouse.	E Trent.	G Humber.
B B Severn.	D Wye.	F Ouse.	H Tees.

ISLANDS.—Anglesey, in North Wales; the Isle of Man, in the Irish Sea, at nearly equal distances from England, Ireland, and Scotland; the chief towns of which are Douglas, Ramsey, Castletown, and Peel. The Isle of Wight, south of Hampshire, remarkable for its fertility and beauty; Guernsey, Jersey, Alderney, and Sark, near the coast of France; Sheppy Island to the north, and Thanet to the north-east of Kent; Coquet, and Holy Island or Lindisfarne, off the coast of Northumberland; the Scilly Isles, south-west of Cornwall; and Lundy Island, in the Bristol Channel.

SAND BANKS.—Dogger Bank, in the German Ocean, between Yorkshire and Jutland; Goodwin Sands, on the east of Kent.

CAPES.—Flamborough Head[a] and Spurn Head, in Yorkshire; North and South Forelands, and Dungeness, in Kent; Beechy Head, in Sussex; Needles, on the west of the Isle of Wight; St. Alban's Head and Portland Point, in Dorsetshire; Start Point, in Devonshire; Lizard Point and Land's End, in Cornwall; St. David's Head, in Pembrokeshire; Holyhead, in Anglesey; Great Orme's Head, in Denbighshire; St. Bee's Head, in Cumberland.

BAYS.—On the *east* coast, Bridlington Bay; Humber Mouth; the Wash; Yarmouth Roads; Mouth of the Thames; the Nore; the Downs.

On the *south* coast, Spithead; Southampton Bay; Poole Harbour; Torbay; Mount's Bay.

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[a] Flamborough Head.—A cliff nearly 500 feet high on which *beacon* fires used to be kindled; and hence it derived its name (*flame* borough). It still deserves its name, as it is the site of a modern light-house.

On the *west* coast, Bristol Channel and Mouth of the Severn; Swansea Bay; Caermarthen Bay; Milford Haven; St. Bride's Bay; Cardigan Bay; Caernarvon Bay; Menai Frith; Mouth of the Dee; Morecambe Bay; Solway Frith.

MOUNTAINS.—The principal mountains are—the *Cheviot*[a] Hills, between Northumberland and Scotland; the *Cumbrian* range, which extends from the western extremity of the Cheviot Hills to the middle of Derbyshire, through the eastern parts of Cumberland, Westmoreland, and Lancashire, and the western portions of Northumberland, Durham, and Yorkshire. The highest mountains of this range are—Scafell,[b] Skiddaw, Bowfell, Crossfell, Saddleback, in Cumberland; Helvellyn, between Cumberland and Westmoreland; Whernside, Ingleborough, and Pen-y-gant, in Yorkshire; and the Peak in Derbyshire.

The *Cambrian* range extends through the middle of Wales, from north to south, from which several spurs are thrown off, both towards the sea coast and the English counties adjoining. Its highest summits are Snowdon[c] and Llewellyn, in Caernarvonshire; Cader Idris and Arran Fowddy, in Merionethshire; Vann or Beacons, in Brecknockshire: and Plynlimmon, between Montgomery and Cardiganshire.

The *Devonian* range extends from the Bristol to the British Channel, through Devonshire and Cornwall. The highest summits of this range are—Dunkerry Beacon, on Exmoor; Cawsand Hill,[d] Rippon Tor, Butterton, on Dartmoor; and Brown Willy, in Cornwall.

To these may be added the Malvern Hills in Worcester; the Wrekin in Shropshire; the Mendip Hills in Somersetshire; and the Cotswold Hills in Gloucestershire.

PRINCIPAL RIVERS.—Rivers flowing into the *German Ocean*:—The Tweed, Tyne, Wear, Tees, Trent, Ouse,[e] Humber, (formed by the Trent, Ouse, and other rivers,) Witham, Welland, Great Ouse, Yare, THAMES, Medway, &c.

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[a] *Cheviot* Hill is 2,658 feet high.

[b] *Scafell*, which is the highest in the range, is 3,166 feet high; *Helvellyn*, 3,055 feet; *Skiddaw*, 3,022; and the others mentioned, between 3,000 and 2,000 feet, except the Peak, which is but 1,018.

[c] *Snowdon* is 3,571 feet high; *Llewellyn*, 3,469; and the others nearly 3,000 feet, except Plynlimmon, which is 2,463.

[d] Cawsand Hill is 1,782 feet high; Dunkerry Beacon, 1,668; Rippon Tor, 1,549; Brown Willy, 1,368; and Butterton, 1,203 feet.

[e] *Ouse.*—This is another form of the word *ooze*, which is formed from the French EAUX, *waters*, like the term BEAUX, which is pronounced similarly, except in its vulgar form *bucks*. This explains why there are so many rivers of this name—as the Yorkshire Ouse, the Great and Little Ouse, and the Sussex Ouse; the term originally signifying the *water* or *waters*; as we say Derwent *water*, the Black *water*, &c.

Into the *Irish Sea.*—The Mersey, Dee, Ribble, Eden, &c.

Into the *Bristol Channel.*—The Severn, Wye, Avon,[a] &c.

Into the *English* or *British Channel.*—South Avon, Wey, Exe,[b] Plym, &c.

LAKES.—Derwent Water, or Keswick Lake, in Cumberland; Ullswater, between Cumberland and Westmoreland; Windermere, between Westmoreland and Lancashire; and Coniston Water, in Lancashire.

PRINCIPAL TOWNS.—*London*, the capital of England, is the largest and richest city in the world. It is upwards of seven miles in length, by five in breadth; and its buildings cover an area of about thirty square miles. Its population amounts to upwards of a million and a half; and for trade and commerce, science and literature, wealth and magnificence, it is the first city in the world.

Liverpool is next to London in commerce and wealth. It is the great emporium of the American trade, for which it is favourably situated, and to which its importance is principally due. Its docks, which are crowded with shipping, are three miles in length. The other great *shipping* and *commercial* towns are, Bristol, Hull, Newcastle-upon-Tyne, Southampton, Sunderland, Stockton, Yarmouth, Falmouth, and Dover.

Manchester is the second city for population, and the first for manufactures. It is the great emporium of the cotton trade, for which England is unrivalled. *Birmingham*, celebrated for *metallic* manufactures, is the next in rank. It gives employment, it is said, to about 70,000 men in the manufacture of fire-arms, engines, and machinery, plated ware, watches, cutlery, &c. *Sheffield* is also distinguished for the manufacture of cutlery and plated goods.

The other great manufacturing towns are, Preston, Bolton, and Blackburn, noted for *cotton* goods. Leeds, Wakefield, Huddersfield, and Exeter, are distinguished for *woollen* goods; Norwich, Coventry, and Macclesfield, for *silks;* Leicester and

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[a] In the same way, the *Irish* or Celtic word *avon*, which signifies *water* or river, came to be the proper name of several rivers; as the Stratford Avon, the Bristol Avon, the Salisbury Avon, and the Avon or *Nen*, in Northamptonshire.

[b] From the Irish or Celtic, or, which is the same thing, the ancient British word UISGE, *water*, several rivers derive their names in a similar way; as the *Esk*, the Exe, the *Axe*, and the *Usk*, in Wales. In Scotland, too, there are several *Esks*.

In a similar way, the term DON has been applied to several rivers; as in Russia, to the *Don*, the N. and S. *Duna* or Dwina, the Dnieper, (that is, *Don*ieper, or *upper river*,) and the Dniester, (*Don*iester, or *lower river*). The *Doon* and *Deen*, as in Aber*deen*, are evidently other forms of the same word.

Nottingnam for *stockings;* Kidderminster for *carpets;* Worcester for *porcelain;* Newcastle-under-Lyne for *pottery;* and Gloucester for *pins.*

Portsmouth, on Portsea Island, is distinguished for its fortifications and fine harbour, which is capable of receiving the whole British navy at once; it is the chief *naval* station of Great Britain. *Plymouth,* at the mouth of the Plym, with its gigantic *breakwater,* is the second. Devonport, Chatham, Sheerness, Woolwich, and Deptford, are distinguished for their extensive *dock-yards;* and Spithead and the Nore are the principal *roadsteads* of the British navy.

Canterbury and *York* are distinguished for their great antiquity and magnificent cathedrals; and *Oxford* and *Cambridge* for their celebrated universities and architectural beauties, particularly Oxford, which has been called a city of palaces. *Windsor* is distinguished for its magnificent castle, the ancient and favourite residence of the sovereigns of England. *Bath* is the most beautiful city in England, and has long been celebrated for its medicinal springs. The other *watering* places of note are, Cheltenham, Leamington, Malvern, Matlock, Buxton, Harrowgate, Tunbridge-Wells, and Clifton. And the places chiefly resorted to for *sea-bathing* are Brighton, Ryde in the Isle of Wight, Hastings, Weymouth, Ramsgate, Margate, Scarborough, and Redcar.

Wrexham is the largest town in North Wales, and is noted for its flannels; *Caernarvon* is celebrated for its castle, in which the first Prince of Wales (Edward II.) was born; *Holyhead* is the usual port of embarkation for Dublin; and *Bangor* and *Beaumaris* are much resorted to for sea-bathing.

In South Wales *Caermarthen* and *Pembroke* are the most important towns. *Cardigan* is noted for its lead, and *Brecknock* for its cloth trade. *Milford Haven* is noted for its excellent and spacious harbour; and *Swansea* is much frequented in summer for sea-bathing.

CLIMATE, SURFACE, AND SOIL.—The *climate* of England, though variable, and somewhat humid, particularly in the western parts of the island, is, generally speaking, mild, genial, and salubrious. Its *surface,* except in the northern and western counties, is generally either level, or composed of gently rising hills and sloping valleys; and its *soil,* particularly in the midland, eastern, and southern counties, is distinguished for its fertility and high state of cultivation. In the north, in particular, there are several barren tracts, and in some of the eastern counties there are extensive fens or marshes; but, in general, England is a fertile, rich, and beautifully-wooded country.

The counties most distinguished for AGRICULTURE are, Kent, Essex, Suffolk, Norfolk, Hampshire, Berkshire, Bedfordshire, Surrey, Sussex, Hertfordshire, part of Lincolnshire. Durham, and Northumberland.

The MINING and MANUFACTURING districts are in the north and west of the island. The principal mineral productions are, coals, iron, copper, lead. tin, and salt. But COALS are by far the most important of the mineral treasures of England. In fact, the manufacturing and commercial wealth of Great Britain is principally due to her inexhaustible supply of coals.[*]

ANTIQUITIES AND CURIOSITIES.—The *antiquities* of England may be classed under four heads, namely, the *British* or

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[*] "It is hardly possible to overrate the advantages Great Britain derives from her vast, and to all practicable purposes, inexhaustible supply of coals. In this climate, fuel ranks among the principal necessaries of life, and it is to our coal mines that we owe abundant and cheap supplies of so indispensable an article. But this is not the only advantage we derive from our coal mines; they are the principal source of our manufacturing and commercial prosperity. Since the invention of the steam-engine, coal has become of the highest importance as a moving power; and no nation, however favourably situated in other respects, not plentifully supplied with this mineral, need hope to rival those that are, in most branches of manufacturing industry. To what is the astonishing increase of Glasgow, Manchester, Birmingham, Leeds, Sheffield. &c., and the comparatively stationary and declining state of Canterbury, Winchester, Salisbury, and other towns in the south of England, to be ascribed? It cannot be pretended, with any show of reason, that the inhabitants of the former are naturally more ingenious, enterprising, or industrious, than those of the latter. The abundance and cheapness of coal in the north, and its scarcity and consequent high price in the south, is the real cause of this striking discrepancy. The citizens of Manchester, Glasgow, &c., are able, at a comparatively small expense, to put the most powerful and most complicated machinery in motion, and to produce results quite beyond the reach of those who have not the same command of coal, or as it has been happily defined—hoarded labour. Our coal mines have been sometimes called the BLACK INDIES; and it is certain that they have conferred on us a thousand times more real advantage than we derive from the conquest of the Mogul empire, or than we should have reaped from the dominion of Mexico and Peru."

This extract is from Mr. M'Culloch's recent and excellent work on Geography, from which also we subjoin the following estimate of the production and consumption of coals in Great Britain in 1839:—

	Tons.
Domestic consumption, and smaller manufactures, . . .	18,000,000
In the production of pig and bar-iron, ...	6,000,000
Cotton manufacture, ...	800,000
Woollen, linen, silk ditto.	800,000
Copper, smelting, brass manufactures, &c., ...	925,000
Salt works, ...	350,000
Lime works, ...	500,000
Railway carriages, steam boats, &c.	1,200,000
	28,575,000
Exports to Ireland, ...	1,000,000
Ditto to Colonies and foreign parts, ...	1,449,417
	31,024,417

Celtic, the *Roman*, the *Gothic*, and the *Danish*. The most remarkable of the British antiquities is *Stonehenge*,[a] in Wiltshire, which is supposed to have been a *Druidical temple;* and in Wales, particularly in the isle of Anglesey, there are many other Druidical remains. The *Roman* antiquities consist of the remains of encampments and fortifications, military ways, altars, inscriptions, arms, coins, &c. The principal *Gothic* antiquities consist of cathedrals, minsters, (as Westminster and Yorkminster), and other architectural relics; and the *Danish* antiquities consist of the remains of raths, circular camps, &c.

The principal natural *curiosities* are the *Peak* and the *petrifactions* in Derbyshire; the *lakes* and scenery of Cumberland, &c.

SCOTLAND.

SCOTLAND, which forms the northern portion of the island of Great Britain, is bounded on the south by the Solway Frith, the Cheviot Hills, and the River Tweed, which separate it from England; on the north by the Atlantic Ocean; on the west by the North Channel and Atlantic Ocean; and on the east by the German Ocean.[b]

Its length from Cape Wrath to the Mull of Galloway, is about 280 miles; and its breadth[b] from Buchan Ness to the most westerly point in Rosshire, is nearly 150 miles.

Its *area* is estimated at 26,016 square miles, exclusive of its islands, which are supposed to contain about 4,000 more; and its *population*, according to the recent returns, amounts to 2,870,784, or upwards of two millions and three quarters.

Scotland is divided into thirty-three counties or shires, which, with their principal towns, are as follow:—

ELEVEN NORTHERN.

Counties.	*Principal Towns.*
Orkney and Shetland,	Kirkwall, Lerwick.
Caithness,	Wick, Thurso.
Sutherland,	Dornoch.
Ross,	Dingwall, Tain, Fortrose.
Cromarty,	Cromarty.

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[a] It consists of the remains of two large concentric *circles* of huge upright stones; and of two *oval* ranges of similar formation, which lie within the circles, and have the same centre. The outer circle is 108 feet in diameter, and the interior, 90. The upright stones are from 18 to 20 feet high, from 6 to 7 broad, and about 3 feet thick. They are placed at the distance of 3½ feet from each other, and are connected at the top by immense stones laid horizontally across them. About 140 of these huge stones still remain.

[b] It lies between $54^\circ\ 37'$ and $58^\circ\ 36'$ north latitude, and between $1^\circ\ 48'$ east, and $6^\circ\ 5'$ west longitude. Its breadth between Alloa on the Frith of Forth, and Dumbarton on the Clyde, is only 32 miles.

Counties.	*Principal Towns.*
Inverness,	Inverness, Fort George, Fort Augustus, Fort William.
Nairn,	Nairn.
Elgin or Murray,	Elgin, Forres.
Banff,	Banff, Cullen.
Aberdeen,	New Aberdeen, Old Aberdeen, Peterhead, Fraserburgh.
Kincardine or Mearns,	Stonehaven, Bervie.
	NINE MIDDLE.
Forfar or Angus,	Dundee, Forfar, Montrose, Brechin.
Perth,	Perth, Dunkeld,[a] Dumblane.
Fife,	Cupar, St. Andrew's, Dunfermline, Kirkaldy, Kinghorn.
Kinross,	Kinross.
Clackmannan,	Clackmannan, Alloa.
Stirling,	Stirling, Falkirk.
Dumbarton or Lennox,	Dumbarton.
Argyll,	Inverary, Campbelton.
Bute,	Rothsay.
	THIRTEEN SOUTHERN.
Haddington or East-Lothian,	Haddington, Dunbar.
Edinburgh or Mid-Lothian,	Edinburgh, Leith, Musselburgh, Dalkeith.
Linlithgow or West-Lothian,	Linlithgow, Bo'ness,[b] Queensferry.
Berwick or Merse,	Greenlaw, Dunse, Coldstream.
Roxburgh,	Jedburgh, Kelso, Hawick, Melrose.
Selkirk,	Selkirk, Galashiels.
Peebles,	Peebles.
Lanark,	Glasgow, Lanark, Hamilton.
Renfrew,	Renfrew, Paisley, Greenock, Port-Glasgow.
Ayrshire,	Ayr, Kilmarnock, Irvine.
Dumfries,	Dumfries, Annan, Moffat.
Kirkcudbright,	Kirkcudbright, New Galloway.
Wigton,	Wigton, Stranraer, Portpatrick.

ISLANDS.—The *Shetland Islands*, the principal of which are Mainland and Yell; the *Orkney Islands*, the chief of which are Mainland or Pomona, and Hoy. The *Hebrides*, or *Western Isles*, the principal of which are Lewis, North and South Uist, Isle of Skye, Rum, Mull, Jura, Isla, Staffa, Iona or Icolmkill; and in the Frith of Clyde, Arran and Bute.

CAPES.—Duncansbay Head, and Dunnet Head, in Caithness; Cape Wrath, in Sutherland; Tarbetness, in Cromarty;

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[a] *Dunkeld*, originally a *fort* or strong place of the ancient *Caledonians*. From the Celtic *dun*, a *hill*; also a *fort* on a hill. Compare *Dunbarton*, that is, the *fort* or residence of the *Britons*.

[b] *Bo'ness*, by contraction from *Borrowstownness*.

Kinnaird's[a] Head, in Aberdeenshire; Fifeness, in Fifeshire; St. Abb's Head, in Berwickshire; Burrow Head, and the Mull[a] of Galloway, in Wigtonshire; the Mull of Cantyre,[a] and Ardnamurchan Point, in Argyllshire, &c.

FRITHS, LOCHS, &c.—The Friths of Pentland, Dornoch, Cromarty, and Murray, to the north of Scotland; the Friths of Tay and Forth, to the east; the Frith of Clyde, to the west; and the Solway Frith, to the south. Wigton Bay, Glenluce Bay, and Loch Ryan; the Minch, between Skye, Lewis, and the mainland. Loch Linnhe, north-west of Argyll; Sound of Mull, Sound of Jura, &c.

MOUNTAINS.—Scotland, in the north and west, is rugged and mountainous. This part of the country is therefore named the *Highlands*;[b] and the southern and south-east parts of it are called the *Lowlands*.

The principal mountain ranges are, the *Grampian Hills*, which extend from Argyll to Kincardine, dividing the Highlands from the Lowlands; the highest summits of which are, Ben Lawers, Schihallion, Ben Lomond, and Ben Ledi. The *Cheviot Hills*, between Roxburgh and Northumberland; the *Lammermoor*[c] *Hills*, between Haddington and Berwickshire; and the *Pentland Hills*, in Edinburgh or Mid-Lothian.

Ben Nevis,[d] in the south of Inverness, is the highest mountain in Scotland; and *Cairngorm*, to the east of the same shire, is the next in height.

RIVERS.—The principal rivers flowing into the *German Ocean* are, the Tweed, Forth, Tay, North and South Esk, the Dee, and the Don.

Into the *Solway Frith*, the Annan, the Nith, and the Esk, in Dumfries-shire; and the Dee, in Kirkcudbrightshire.

Into the *Frith of Clyde*, the Clyde, the Ayr, and the Doon.

Into the *Atlantic*, north of Scotland, the Spey, the Findhorn, and the Deveron.

The Teviot, in Roxburgh, and the Ettrick, in Selkirk, flow into the Tweed; and the Earn or Erne into the Tay.

LAKES.—Lochs Lomond and Katrine, in the south of the

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[a] *Mull*, from the Celtic *maol*, means a *bald* or *bare* head land; and *Cantyre* is from *cean* or *ken*, head, and *tir* (*terra* L.) land. Compare *Kenmore*, the great head; *Kinross*, the head of a promontory or *peninsula*; *Kenlis*, the English title of the Marquess of *Headfort*, (Baron *Kenlis*.) *Kinnaird*, that is the *high* or lofty head.

[b] The Highlands consist of the counties of Sutherland, Ross, Inverness, and Argyll; of the western part of Perthshire; and of the mountainous parts in Murray, Banff, and Aberdeen shires.

[c] *Lammermoor*, that is, the *moor* that reaches (*à la mer*) to *the sea*.

[d] Ben Nevis is 4,350 feet high; Cairngorm, 4,060; Ben Lawers, 4,015, Schihallion, 3,564; Ben Lomond, 3,202; and Ben Ledi, 3,009.

Highlands, celebrated for their beautiful and picturesque scenery. Loch Ness and Loch Lochy, in Invernesshire, connected by the great Caledonian Canal, which runs in the direction of these lochs, from Fort William to Fort Augustus. Loch Tay, Loch Earn, and others in Perthshire; Loch Awe, in Argyll; Loch Leven, in Kinross, &c.

CLIMATE, SURFACE.—The climate of Scotland differs from that of England in being several degrees colder. The surface of the country, particularly in the north and west, is rugged, mountainous, and, with the exception of a few fertile valleys, ill adapted for agriculture.

The middle parts of the country, particularly the valleys of the Grampians, afford good pasturage for sheep and black cattle, immense numbers of which are annually driven to be fattened in the rich pastures of England.

In the Lowlands, or south-eastern parts of Scotland, AGRICULTURE is much advanced, and the soil is in general fertile. The grains chiefly cultivated are, oats, rye, and barley.

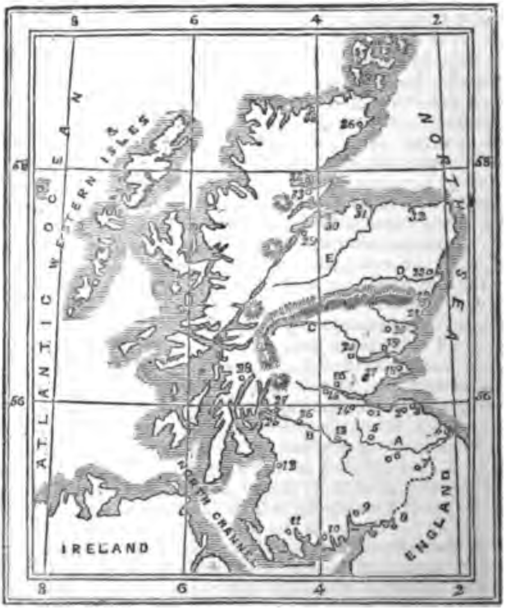
Scotland is rich in minerals, particularly in coals, iron, lead, and copper; and its MANUFACTURES and COMMERCE are extensive and flourishing. Its chief manufactures are cotton goods, linen, ironware, and glass.

PRINCIPAL TOWNS.—*Edinburgh*, near the Frith of Forth, is the metropolis of Scotland. It is a beautiful city, and has long been distinguished as the seat of science and literature. It has few manufactures; but it carries on an important trade through *Leith*, its seaport, which is about two miles distant. *Glasgow*, on the Clyde, is the first city in Scotland for population, manufactures, commerce, and wealth. *Greenock* is the principal seaport of Scotland. *Paisley* is noted for its extensive manufactures of cotton and fancy goods. *Aberdeen*, at the mouth of the Dee, is the principal town in the north of Scotland. *Perth* is a large, handsome, and flourishing town. *Dundee*, on the Frith of Tay, is a large and commodious seaport, with an extensive and flourishing trade.

Scotland has five universities—Edinburgh, Glasgow, New Aberdeen, Old Aberdeen, and St. Andrews.

ANTIQUITIES AND CURIOSITIES.—The *antiquities* are the remains of *Druidic* temples and altars; the remains of the great *Roman* wall which ran from the Frith of Clyde to the Frith of Forth; vestiges of Roman roads, camps, &c.; and *Danish* camps and raths. The principal natural *curiosities* are the basaltic columns and the cave of Fingal, in the island of Staffa; the Fall of Fyers, near Loch Ness, and the Falls of the Clyde, near Lanark; and the lakes, which are numerous and beautiful.

SCOTLAND.



References to the Map of Scotland.

Aberdeen,	23	Elgin,	31	Linlithgow,	14
Ayr,	12	Forfar,	20	Montrose,	21
Banff,	32	Glasgow,	26	Nairn,	30
Bervie,	22	Greenock,	25	Peebles,	5
Berwick,	4	Haddington,	2	Perth,	24
Carlisle,	8	Inverary,	28	St. Andrews,	18
Clackmannan,	16	Inverness,	29	Selkirk,	6
Dornoch,	34	Jedburgh,	7	Stirling,	15
Dumbarton,	27	Kinross,	17	Tain,	33
Dumfries,	9	Kirkcudbright,	10	Thurso,	35
Dunbar,	3	Kirkwall,	37	Wick,	36
Dundee,	19	Lanark,	13	Wigton,	11
Edinburgh,	1				

RIVERS.

A Tweed. | B Clyde. | C Tay | D Dee. | E Spey

IRELAND.

IRELAND lies in the Atlantic Ocean to the west of Great Britain, from which it is separated by St. George's Channel on the south-east; by the Irish Sea on the east; and by the North Channel on the north-east.

Its length from Fair Head in Antrim, to Mizen Head in Cork, is about 300 miles; and its breadth from Howth Head in Dublin, to Slyne Head in Galway, is about 170 miles.[a]

Its *area* is estimated at nearly 32,000[b] square miles; and its *population*, according to the census in 1851, amounts to 6,515,794, or about six millions and a-half. (See note p. 182).

Ireland is divided into four provinces—*Leinster* in the east, *Ulster* in the north, *Munster* in the south, and *Connaught* in the west.

These provinces are subdivided into thirty-two COUNTIES, which, with their principal towns, are as follow:—

LEINSTER, TWELVE COUNTIES.

Counties.	*Principal Towns.*
Louth,	Drogheda, Dundalk, Ardee, Carlingford.
Meath,	Trim, Navan, Kells.
Westmeath,	Mullingar, Athlone, Moate, Kilbeggan.
Longford,	Longford, Granard, Edgeworthstown.
Dublin,	DUBLIN, Kingstown, Balbriggan.
Kildare,	Athy, Kildare, Naas, Maynooth.
King's County,	Tullamore, Birr or Parsonstown, Banagher, Edenderry, Philipstown.
Queen's County,	Maryborough, Portarlington, Mountmellick, Mountrath.
Carlow,	Carlow, Tullow, Leighlin.
Wicklow,	Wicklow, Arklow, Bray, Enniskerry.
Wexford,	Wexford, New Ross, Enniscorthy.
Kilkenny,	Kilkenny, Callan, Castlecomer.

ULSTER, NINE COUNTIES.

Donegal,	Ballyshannon,[c] Letterkenny, Lifford.
Londonderry,	Londonderry, Coleraine, Newtownlimavady, Kilrea.
Antrim,	Belfast, Lisburn, Ballymena, Carrickfergus,[d] Larne, Antrim.

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[a] Ireland lies between 51° 25′ and 55° 23′ north latitude; and between 5° 20′ and 10° 20′ west longitude.

[b] The estimate is 31,874 square miles, of which 711 are water.

[c] *Ballyshannon.*—The term *Bally* or *Bal* is from the Irish or Celtic word *baile*, a town or village; also, a townland. Hence its frequent occurrence in the names of places in Ireland; as *Ballymore*, that is, the *great* town; *Ballinrobe*, the town on the *Robe*; *Ballinahinch*, the town on the *island*; *Ballymony*, the town on the *bog*; *Ballintra*, the town on the *strand*, or Strandtown.

[d] *Carraig* or *Craig* means a *rock*; also, a castle or town built on, or near a rock. Hence Carrickfergus, the castle of *Fergus*. (built on a rock;) *Carrick-on-Suir*. *Carrick*-on-Shannon, &c.

Counties.	*Principal Towns.*
Down,	Newry, Downpatrick, Newtownards, Bangor, Banbridge, Hillsborough, Donaghadee, Dromore, Holywood.
Armagh,	Armagh, Lurgan, Portadown, Charlemont
Monaghan,	Monaghan, Clones, Carrickmacross.
Tyrone,	Dungannon, Omagh, Strabane.
Fermanagh,	Enniskillen,[a] Lowtherstown.
Cavan,	Cavan, Cootehill, Belturbet, Kingscourt
	MUNSTER, SIX COUNTIES.
Waterford,	Waterford, Dungarvan, Lismore.
Tipperary,	Clonmel, Cashel, Nenagh, Roscrea, Thurles Tipperary, Carrick-on-Suir.
Clare,	Ennis, Kilrush, Killaloe.[b]
Limerick,	Limerick, Rathkeale, Newcastle.
Cork,	Cork. Bandon, Youghal, Kinsale, Mallow
Kerry,	Tralee,[c] Killarney, Dingle.
	CONNAUGHT, FIVE COUNTIES.
Roscommon,	Boyle, Roscommon.
Leitrim,	Carrick-on-Shannon, Manorhamilton.
Sligo,	Sligo, Ballymote.
Mayo,	Castlebar, Ballina, Westport, Killala.
Galway,	Galway, Tuam, Loughrea, Ballinasloe.

ISLANDS.—Rathlin, north of Antrim; Tory Island and North Isles of Arran, west of Donegal; Achil Island, Clare Island, and Innisbofin, west of Mayo; South Isles of Arran, in Galway Bay; Valentia Island, west of Kerry; Cape Clear Island, south of Cork.

CAPES.—Fair Head and Bengore Head, north of Antrim; Malin Head, north of Donegal; Urris Head, in Mayo; Slyne Head, in Galway; Loop Head, in Clare; Mizen Head, in Cork; Cape Clear, in the Island of Cape Clear; Carnsore Point, in Wexford; Wicklow Head; and Howth Head.

BAYS, LOUGHS.—Dublin Bay, Dundalk Bay, Carlingford Bay, Dundrum Bay, Strangford Lough, Carrickfergus Bay or Belfast Lough, Lough Foyle, Lough Swilly, Donegal Bay Sligo Bay, Killala Bay, Broad Haven, Blacksod Bay, Clew Bay,

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[a] ***Ennis***, from the Irish *inis* or *inch*, the root of which is the Latin *insula*, an island. Hence *Innismore*, the *great* island; *Innisbeg* the *little* island; ***Innishowen***, the island of *Owen*; Ennis*killen*, Innis*magrath*, &c.

[b] ***Kill***, a *cell*, (cella, L.); a church, a church-yard or burying-place. Hence ***Kilkenny***, that is, the church of *Kenny* or St. *Canice*; *Kilpatrick*, the church of *Patrick*; *Kilbride*, the church of St. *Bride* or Bridget; *Kilmore*, the *great* church; *Kildare*, the church of the *oak*. But as *kill* (*coille*, Gaelic) also signifies a wood, perhaps *Kildare* means the wood of *oaks* (*darech*). From the preceding root are derived *Derry* and *Derg*.

[c] ***Tralee***, that is, the strand (*traigh*) of the Leigh or Lee. Compare *Tramore*, the great strand, &c.

Galway Bay, Mouth of the Shannon, Tralee Bay, Dingle Bay, Kenmare River, Bantry Bay, Kinsale Harbour, Cork Harbour, Dungarvan Bay, Waterford Harbour, Wexford Harbour.

Mountains.—Compared with Scotland, and the north and west of England, Ireland may be said to be a level country. Its surface, however, is much diversified; and even where it is quite flat, the prospect is generally bounded by hills or mountains in the distance.

The principal mountains in Ireland are—Magillicuddy's Reeks[a] and Mangerton, in Kerry; Croagh Patrick and Nephin, in Mayo; the Mourne Mountains, in Down; the Wicklow Mountains, in Wicklow;[b] and the Devil's Bit and Slieve Bloom Mountains, in Tipperary, King and Queen's Counties.

Rivers.—The Shannon, one of the largest and most important rivers in the United Kingdom, the Barrow, the Blackwater, the Bann, the Suir, the Nore, the Liffey, the Boyne, the Slaney, the Derg, the Foyle, the Lee, the Bandon, the Lagan, the Ovoca, &c.

Lakes.—Lough Neagh, Lough Erne, Loughs Allen, Ree, and Derg, expansions of the Shannon; Lough Corrib, in Galway; Lough Mask, in the south, and Lough Conn in the west of Mayo; and the Lakes of Killarney in Kerry, celebrated for the picturesque beauty of their scenery.

Climate, Soil.—The climate of Ireland is mild, genial, and salubrious; but its great defect is excess of humidity, which arises from its insular position, and the prevalence of *westerly* winds. The excellent pasturage and beautiful verdure[c] for which Ireland is so remarkable, are owing principally to the moisture it receives from the vapours of the Atlantic. The soil is in general more fertile than that of England, but not so well cultivated.

Agriculture.—Great improvements in agriculture have been made in Ireland within the last few years, and societies for the further improvement of it are extending over the country.

Commerce.—Ireland possesses many natural advantages for commerce. Its harbours are numerous and commodious, and its coasts are so indented on all sides, that there is scarcely any place in the country more than fifty miles from the sea. The principal exports of Ireland are cattle, corn, beef, butter, pigs, bacon, hides; also linen, yarn, and flax; copper and lead ore, &c. The principal manufacture is linen, which is chiefly confined to the north. Dublin is distinguished for its beautiful tabinets, and Limerick for its lace.

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[a] *Carn Tual* in Magillicuddy's Reeks, the highest mountain in Ireland, has an elevation of 3,410 feet.

[b] *Lugnaquilla*, the highest of the Wicklow Mountains, is about 3,000 feet; and *Slieve Donard*, the highest of the Mourne Mountains, is about 2,660 feet.

[c] Hence the poetical name of Ireland, the *Green* or Emerald Isle.

PRINCIPAL TOWNS.—*Dublin*, the metropolis of Ireland, is the second city in the British Isles in extent and population. It is considered one of the most beautiful cities in Europe. The elegance of its buildings, the beauty of its bay, and the picturesque scenery of the surrounding country, are greatly and justly admired.

Cork, the second city in Ireland, is distinguished for its fine harbour and extensive commerce.

Belfast, the most flourishing, and the most literary town, in Ireland, is the next in importance. It is the chief seat of the linen manufacture, and its commerce is most extensive.

Limerick, on the Shannon, is usually considered the third city in Ireland, but Belfast exceeds it both in population and commerce.

Waterford is next to Limerick in importance.

Londonderry, *Newry*, *Drogheda*, and *Galway*, are important seaports; and *Kilkenny* and *Armagh* the chief inland cities of Ireland.

ANTIQUITIES AND CURIOSITIES.—The principal *antiquities* are the *round towers*, Druidic altars, and the remains of Danish raths or circular intrenchments. The principal natural *curiosities* are the Giant's Causeway in the northern extremity of the County of Antrim, the scenery of Wicklow, and the Lakes of Killarney.

POPULATION OF THE BOROUGH TOWNS IN IRELAND.

Name.	Population in 1851, exclusive of Paupers.	Paupers in the Work-house.	Name.	Population in 1851, exclusive of Paupers.	Paupers in the Work-house.
Armagh,	9,306	478	Enniskillen,	5,998	869
Athlone,	6 218	1,766	Galway,*	20,686	3,009
Bandon,	6,929	1,632	Kilkenny,	15,808	4,165
Belfast,*[1]	100,300	1,803	Kinsale,	5,506	934
Carlow,	9,121	2,461	Limerick,*	53,448	4,487
Carrickfergus,	3,543	—	Lisburn,	6,509	363
Cashel,	4,798	3,449	Londonderry,	19,888	591
Clonmel,	15,518	2,818	Mallow,	5,436	811
Coleraine,	5,920	312	New Ross,	7,070	2,028
Cork,*	85,745	4,277	Newry,	13,191	883
Downpatrick,	4,098	532	Portarlington,	2,728	—
Drogheda,	16,845	688	Sligo,	11,104	2,216
Dublin,*	252,613	5,748	Tralee,	9,937	5,199
Dundalk,	9,995	988	Waterford,*	23,339	1,958
Dungannon,	3,854	414	Wexford,	12,471	348
Dungarvan,	6,417	923	Youghal,	7,410	1,801
Ennis,	8,623	3,542			

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[1] The towns marked with an *asterisk* return two members each; and n, four, but two are for the University. All the other towns return one tative each.

EXTENT AND POPULATION OF THE PROVINCES AND COUNTIES OF IRELAND.

Provinces and Counties.	Statute Acres.[a]	Population in 1841.	Provinces and Counties.	Statute Acres.[a]	Population in 1841.
LEINSTER:			ULSTER:		
Carlow, .	221,342	86,228	Antrim, .	761,877	360,875
Dublin, .	226,414	372,773	Armagh, .	328,076	232,393
Kildare, .	418,436	114,488	Cavan, . .	477,360	243,158
Kilkenny, .	509,732	202,420	Donegal, .	1,193,443	296,448
King's Co., .	493,985	146,857	Down, . .	612,495	361,446
Longford, .	269,409	115,491	Fermanagh, .	457,195	156,481
Louth, . .	201,906	128,240	Londonderry,	518,595	222,174
Meath, .	579,899	183,828	Monaghan, .	319,757	200,442
Queen's Co.,	424,854	153,930	Tyrone, .	806,640	312,956
Westmeath,	453,468	141,300			
Wexford, .	576,588	202,033	Total, .	5,475,438	2,386,373
Wicklow, .	500,178	126,143			
			CONNAUGHT:		
Total, .	4,876,211	1,973,731	Galway, .	1,566,354	440,198
			Leitrim, .	392,363	155,297
MUNSTER:			Mayo, . .	1,363,882	388,887
Clare, . .	827,994	286,394	Roscommon,	607,691	253,591
Cork, . .	1,846,333	854,118	Sligo, . .	461,753	180,886
Kerry, . .	1,186,126	293,880			
Limerick, .	680,842	330,027	Total, .	4,892,043	1,418,859
Tipperary, .	1,061,731	435,553			
Waterford, .	461,553	196,187			
Total, .	6,064,579	2,396,161	Total of Ireland	20,808,271	8,175,124

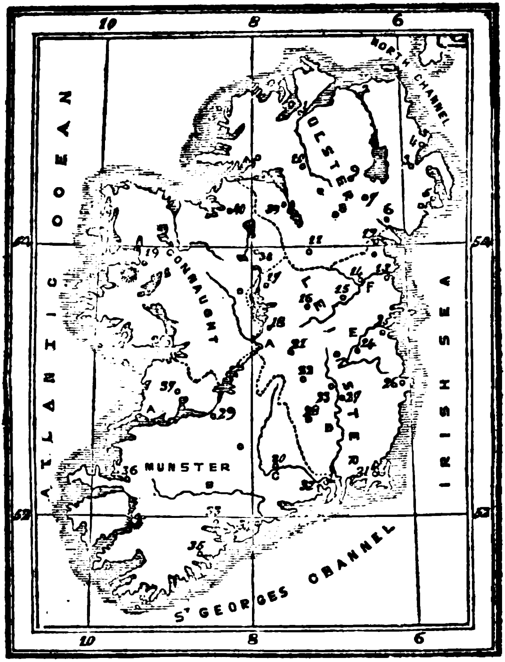
POPULATION OF IRELAND AT DIFFERENT PERIODS.[b]

Years.	Population.	Years.	Population.	Years.	Population.
1672	1,100,000	1767	2,544,276	1813	5,937,856
1712	2,099,094	1777	2,690,556	1821	6,801,127
1726	2,309,106	1785	2,845,932	1831	7,767,401
1754	2,372,634	1805	5,395,466	1841	8,175,124

[a] In each county there is a large extent of surface unfit for cultivation. The proportion, of course, varies in each province and county. The number ot *arable* acres in each province is as follows:—Leinster, 3,961,188; Munster, 3,874 613; Ulster, 3,407,539; Connaught, 2,220,960. Hence, it appears that Leinster is the most, and Connaught the least extensively cultivated, in proportion to their extent. If 100 be taken to represent the whole surface of Ireland, it may be divided as follows:—Arable land, 64·7; plantations, 1·7; uncultivated, 30·3; towns, ·2; water, 3.

[b] According to the late census (1851), the population of Ireland is but 6,515,794, that is, a *decrease*, within 10 years, of nearly 20 per cent. In the province of Connaught, the decrease is 28·7 per cent.; in Munster, 22·5; in Ulster, 15·9; and in Leinster, 15·3.

IRELAND.



References to the Map of Ireland.

Armagh,	7	Cork,	33	Kinsale,	35	Omagh,	10
Athlone,	18	Downpatrick,	5	Limerick,	29	Sligo,	40
Belfast,	3	Dublin,	25	Londonderry,	1	Tralee,	36
Carlow,	27	Dungannon,	9	Longford,	17	Trim,	15
Carrickfergus,	4	Dundalk,	12	Maryborough,	22	Tullamore,	21
Cavan,	11	Drogheda,	13	Monaghan,	8	Waterford,	32
Carrick-on-Shannon,	38	Ennis,	37	Mullingar,	16	Westport,	19
		Enniskillen,	39	Naas,	24	Wexford,	31
Clonmel,	30	Galway,	20	Navan,	14	Wicklow,	26
Coleraine,	2	Kilkenny,	28	Newry,	6	Youghal,	34

RIVERS.

A Shannon. | B Blackwater. | C Suir. | D Barrow. | E Liffey. | F Boyne.

HISTORICAL SKETCH OF
GREAT BRITAIN AND IRELAND.

ENGLAND was originally peopled by the ancient CELTS, who, migrating from Asia in the earliest ages of the world, gradually spread over the *south* and *west* of Europe, and the adjoining islands.

At subsequent periods the eastern and southern coast was occupied by the *Belgæ* and other GOTHIC tribes, who also originally migrated from Asia, the cradle of the human race, and spread over the *north* and *north-west* of Europe.

The *Phœnicians* traded with the inhabitants of Cornwall for tin[a] several centuries before the Christian era; but little was known of the country till the invasion of it by the ROMANS, under Julius Cæsar. This event occurred in the fifty-fifth year before the Christian era.

At this period its inhabitants had made little progress in civilization. They had nothing deserving the name of city or town; their dwellings were mere hovels; and their clothing was the skins of animals. The parts of their bodies which were exposed they *painted* or stained with the juice of herbs, from which custom it is said they were called *Britons*, and the country *Britannia*, that is, the *painted nation*.[b] They were, however, a brave and warlike people; and it was not without difficulty that the victorious legions of Cæsar reduced them to submission. After the time of Cæsar, Britain remained unmolested by the Romans for nearly a hundred years. In the year 43, after the Christian era, an expedition was despatched by the Emperor Claudius to complete the conquest of the country, which was finally effected in about 20 years after by the celebrated Roman general, Agricola.

The Romans continued to keep possession of the country till about the year 430, at which period they were obliged to withdraw all their troops from the out provinces for the defence of Italy against the *barbarous nations of the north*.

Under the Romans the arts of peace were introduced into Britain, and the natives rapidly advanced in civilization; but they entirely lost the martial spirit and love of freedom for which their ancestors were so distinguished. Hence, on the departure of the Romans, the Britons became an easy prey to their rude and rapacious neighbours, the PICTS and the SCOTS.

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[a] Hence, the term *Cassiterides* or *Tin* islands, which was afterwards restricted to the Scilly Isles.

[b] The PICTS, according to some authors, derived their name from the same custom, which is indeed common to most barbarous nations.

Having in vain besought the Romans to return, they solicited the SAXONS, a warlike people of northern Germany, to fight their battles against the Picts and the Scots, offering them as a reward for their services the Isle of Thanet, which forms a part of the county of Kent.[a]

The SAXONS, under Hengist and Horsa, arrived in Britain in the year 449; and having repelled without difficulty the Picts and Scots, they turned their arms against the Britons themselves, whom they dispossessed of the south-eastern part of the island. The success which attended the arms of the Saxons, and the favourable accounts of the beauty and fertility of the country, attracted numerous bands of their countrymen; and with them a kindred tribe called ANGLES or Anglo-SAXONS, who it is supposed occupied that part of Germany between the Elbe and the Eyder. It was from this tribe that the country was afterwards called ENGLAND, that is, *Angle land* or land of the Angles. The Saxons, Jutes, and Angles, having destroyed, enslaved, or expelled the inhabitants, particularly of the south-eastern and eastern parts of the country, established ***seven*** independent ***kingdoms*** since known by the name of the SAXON HEPTARCHY.

The Britons that escaped from the slaughter or subjugation of the Saxons, took refuge either in Cornwall or Wales, or passed over into Armorica, in France, where they settled in great numbers among a kindred people, and gave their name to the province of *Bretagne* or *Brittany*. The Britons that settled in Wales maintained their independence till the time of Edward I.; and their descendants are to this day called the *Ancient Britons*.

Under the Saxons the customs and manners of the country were changed, as well as its name; and the language, which had been either Celtic or Latin, gave way to the Anglo-Saxon, from which the modern English is principally derived.

In the year 827 the several kingdoms of the Heptarchy were united into one, under the name of ENGLAND, by Egbert king of Wessex or the *West Saxons*. Egbert was therefore the first king of England.

About the year 866 the DANES invaded England, and took possession of the country north of the Humber; and in 1017 they were in possession of the whole kingdom, under Canute the Great, king of Denmark and Norway. But during the reign of Alfred the Great, from 871 to 901, the Danes were kept in check, and for a time expelled from the country.

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[a] The Isle of Thanet is separated from Kent by a narrow channel, formed by the river Stour. In it are the towns of Margate, Ramsgate, and several villages.

On the death of Hardicanute, the son of Canute, in 1042. the Saxon monarchy was restored in the person of Edward the Confessor. Upon this monarch's death, in 1066, Harold, brother of the queen, usurped the crown; but in the same year he was defeated and slain at the battle of Hastings, by William Duke of Normandy, who claimed the kingdom under the will of Edward the Confessor. This event is known by the name of the NORMAN CONQUEST; and the Duke of Normandy, who was crowned immediately after as king of England, is called William the Conqueror. Under the Normans great changes were made in the customs, laws, and language of England.

The most important events in English history that have since taken place, are:—1. The annexation of Ireland to England in the reign of Henry II. in 1172. 2. The granting of Magna Charta by John in the year 1215. 3. The invasions of France by Edward III. and Henry V. 4. The wars between the houses of York and Lancaster in the fifteenth century. 5. The union of the crowns of England and Scotland under James I. in 1603. 6. The great civil war in the reign of Charles I.; and the establishment of the commonwealth under Cromwell in 1649. 7. The Restoration under Charles II. in 1660. 8. The Revolution and abdication of James II. in 1688. 9. The legislative union between England and Scotland in 1707. 10. The accession of the house of Hanover in 1714. 11. The American War, 1776—1784. 12. The war with revolutionary France, 1793—1815. 13. The legislative union between Great Britain and Ireland, 1800.

SCOTLAND.

Scotland, like England, was originally peopled by the ancient *Celts*. As in England, too, the primitive inhabitants were in process of time driven to the *western* or *mountainous* part of the country by Saxon and other *Gothic* tribes, who possessed themselves of the *Lowlands* or south-eastern part of the island. Hence the difference which still exists between the inhabitants of the Highlands and those of the Lowlands of Scotland. Hence, too, the *Highland* Scotch are called *Gaels*,[a] just as those parts of England to which the ancient British retired were called *Wales* and Corn*wall*.

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[a] The terms *Gael*, *Gaul*, *Wales* and *wall*, as in Corn*wall*, are evidently different forms of the ancient Celtic word, *gal*, the meaning of which seems to be *west* or *westward*. Thus, *Gaul* (the ancient name of France) is in the west of Europe; Wales (*Galles* in French) is in the west of England; and *Gael* in the *west* of Scotland. Hence, also, *Galway* (and *Gall*oway), the *western* direction (as Norway is the *northern*); Done*gal*, &c.

The ancient name of Scotland was *Caledonia.* By the Romans, who invaded it under Agricola in the year 79, it was called *Britannia Barbara;* in the eighth century it was called the country of the Picts;[a] and in the eleventh century it received its present name—SCOTLAND, which had been previously applied to Ireland.

The Picts and Scots[b] were united into one nation about the year 843, by Kenneth Mac Alpin. His successors were chiefly employed in wars against the English and Danes. Duncan expelled the Danes from his dominions; but, in 1038, he was murdered by Macbeth, who was himself slain two years after by Macduff.

The most important events in the history of Scotland are the wars with the first three Edwards of England, in which BRUCE and WALLACE were so distinguished for their patriotism and heroic deeds. The life and times of the beautiful but unfortunate Queen of Scots, Mary Stuart, is an interesting period in Scottish history; and the accession of her son James to the throne of England, was an event of the greatest importance to both nations. This occurred in 1603; and since that period the two kingdoms have been under one sovereign. In 1707 the Legislative Union between Great Britain and Scotland was effected; and the two countries have since been called GREAT BRITAIN.

IRELAND.

Ireland, like the sister kingdoms, England and Scotland, was originally peopled by the ancient CELTS; and like them, too, its coasts, though in a less degree, were at subsequent periods taken possession of by GOTHIC tribes. Its ancient name was Ierne,[c] which means, according to some authorities, the *sacred* isle; according to others, the *western.* It was called *Juverna, Hibernia,* and *Britannia Minor,* by the Romans; and subsequently, *Scotia* or Scotland. In the eleventh century this term was transferred to Scotland, and Ireland resumed its ancient name.

Ireland was probably visited by the PHŒNICIANS in their voyages to England for tin; but little is *historically* known of it for several centuries after the Christian era.

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[a] The similarity which still exists between the *Welsh* and *Gaelic* languages proves that they were originally the same; and it is well known that the Gaelic differs very little from the *Irish,* from which circumstance it is frequently called *Erse,* that is, *Irish.*

[b] The *Picts* and *Scots* were of Scandinavian origin.

[c] *Ierne.*—Hence its modern names ERIN and (*Ierneland*) IRELAND. From *Ierne* the names *Juverna* and *Hibernia* also may be easily deduced.

In the fifth century, Christianity was introduced into Ireland by St. Patrick, and it soon after became distinguished as the seat of learning, and so continued for several centuries

The country suffered much from the invasion of the Danes; and in 845 they were in possession of almost the whole kingdom. They were, however, soon after defeated and expelled

In the reign of Henry II. in 1172, Ireland was annexed to the English crown.

In the reign of James I. several colonies from England and Scotland were introduced into Ireland; and great improvements were made in the laws and in the administration of justice.

In 1641 Ireland, as well as England, was involved in a civil war which was terminated by Cromwell.

In 1800 the Legislative Union between Ireland and Great Britain was effected; and, in 1829, the Emancipation Bill was passed, which relieved the Roman Catholics of the United Kingdom from the disabilities under which they laboured on account of their religion.

In 1832 the National Education Board was established by Government upon principles which must ensure its success, and from which the happiest results may be expected.

In 1838 the Great Temperance movement began under that truly excellent and extraordinary man, the Rev. Theobald Mathew.

SOVEREIGNS OF ENGLAND SINCE THE NORMAN CONQUEST, WITH THE TIMES AT WHICH THEY BEGAN TO REIGN.

William I.	1066	11th century.
William II.	1087	
Henry I.	1100	
Stephen	1135	12th century.
Henry II.	1154	
Richard I.	1189	
John	1199	
Henry III.	1216	13th century.
Edward I.	1272	
Edward II.	1307	14th century.
Edward III.	1326	
Richard II.	1377	
Henry IV.	1399	
Henry V.	1413	15th century.
Henry VI.	1422	
Edward IV.	1461	
Edward V.	1483	
Richard III.	1483	
Henry VII.	1485	
Henry VIII.	1509	16th century.
Edward VI.	1547	
Mary I.	1553	
Elizabeth	1558	
James I.	1603	17th century.
Charles I.	1625	
Charles II.	1649	
James II.	1685	
William III. Mary II.	1688	
Anne	1702	18th century.
George I.	1714	
George II.	1727	
George III.	1760	
George IV.	1820	19th century.
William IV.	1830	
VICTORIA	1837	

FRANCE.

Boundaries.—France is bounded on the north by Belgium and the English Channel; on the west by the Bay of Biscay; on the south by the Pyrenees and the Mediterranean; and on the east by Italy, Switzerland, and Germany.

France lies between 42° 20′, and 51° 5′ N. latitude; and between 4° 46′ W., and 8° 16′ E. longitude. Its length, from Dunkirk to the Pyrenees, is 600 miles; and its breadth, from the western extremity of Bretagne to Strasbourg, is 580 miles. Its EXTENT is 203,736 square miles: and its POPULATION in 1840, was 34,136,677.

Divisions.—France was formerly divided into 35 provinces, but at the Revolution it was subdivided into 86 departments,[a] most of which take their names from rivers and mountains within their boundaries.

Before the Revolution of 1789, it was divided into 35 provinces, namely, French Flanders, Artois, Picardy, Normandy, Isle of France, Champagne, Lorraine, Alsace, Bretagne, Maine, Anjou, Touraine, Orleanais, Berri, Nivernois, Bourbonnais, Burgundy, Franche-Comté, Poitou, Aunis, Saintonge, Angoumois, La Marche, Limousin, Auvergne, Lyonnais, Guienne, Gascony, Bearn, Foix, Rousillon, Languedoc, Dauphiné, Avignon, Provence.

Chief Towns.—Paris,[b] the metropolis, on the Seine; Lyons, at the junction of the Rhone and the Saône; Marseilles, on the Gulf of Lyons; Bordeaux, on the Garonne; Rouen, on the Seine; Nantes, on the Loire; Toulouse, on the Garonne; Lisle[c] or Lille, in French Flanders; Strasbourg, on the Rhine; Orleans, on the Loire; Toulon, on the Mediterranean; Havre-de-Grace, at the mouth of the Seine; Brest, and Cherbourg, on the English Channel; with several other large and important towns.[d] Also, Bastia and Ajaccio, in Corsica, the latter of which is distinguished as the birth-place of Napoleon.

Paris is the second city in Europe in size, and, perhaps, the first in splendour. For palaces, public buildings, promenades, and places of amusement, it is unrivalled. It is also distinguished for the number and high character of its literary and scientific institutions. *Lyons*, the second city in France, has long been distinguished as the first silk manufacturing city of Europe. It still furnishes more than half of all the silk goods produced in France. *Marseilles*, which was considered an ancient city in the time of Julius Cæsar,[a] is one of the most flourishing and most important cities in France. It is the great outlet for the produce and manufactures of the southern provinces; and the channel of communication between France and the northern coasts of Africa, and the Levant. It is also the best and most frequented port in the Mediterranean. *Bordeaux* is the next city in commercial importance; and next, *Havre-de-Grace*, which may be regarded as the seaport of Paris. The other great commercial and manufacturing cities of France, are Nantes, Rouen, Lisle, and Toulouse.

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[a] The island of *Corsica* forms one of the departments.

[b] The present population of Paris is 912,032, and if the garrison and strangers are included, about 1,000,000. Of Lyons, the population is about 170,000; of Marseilles, 150,000; of Bordeaux, 110,000; of Rouen, 95,000; of Nantes, 80,000; of Toulouse, 75,000; of Lisle, 70,000; of Strasbourg, 60,000; of Toulon, 45,000; of Orleans, 40,000; of Havre, 30,000; of Brest, 80,000; and of Cherbourg, 20,000.

[c] *Lisle*, that is, *the isle*, from having been formerly surrounded with marshes.

[d] As Amiens, Caen, Nismes, Nancy, Montpelier, Rheims, Rennes, Besançon, Tours, Boulogne, Dunkirk, &c., with populations from 40,000 to 25,000.

Strasbourg is celebrated for its cathedral, the spire of which is 466 feet high,[b]; *Orleans*,[c] for its great antiquity, and the exploits of Joan of Arc; *Nismes*, for its Roman antiquities; and *Tours*, as the place where Charles Martel defeated and drove the Saracens from France (in 732).

Brest and *Toulon* are distinguished as the chief naval stations in France, the former on the Atlantic, and the latter on the Mediterranean. *L'Orient* and *Rochefort* are also naval stations.

Amiens is noted for an important treaty between England and France in 1802; and *Montpelier* is much resorted to for the salubrity of its climate.

MOUNTAINS.—The Pyrenees, Alps, Puy-de-dôme, Mont Jura, Côte d'Or, the Cevennes, and the Vosges.

RIVERS.—The principal rivers are the Seine, the Loire, the Garonne, the Rhone, the Rhine, and the Meuse.

These six rivers may be regarded as the principal basins, into some one of which almost all the other rivers of France empty.

LAKES.—The lakes, which are few and small, are principally in Provence.

CANALS.—Languedoc,[d] Burgundy, and Orleans.

ISLANDS.—The principal islands are Corsica, Ushant, Belle isle, Isles of Rhe, Oleron, and Hieres.

CAPES.—La Hogue, and Barfleur.

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[a] *Marseilles* was founded by the Phocians 539 years before the Christian era.

[b] That is, about 7 feet higher than St. Peter's in Rome, and about 5 feet higher than the great pyramid of Cheops. The clock of this cathedral is celebrated for the extraordinary ingenuity of its mechanism. It shows the motions of the earth and planets, and the increase and decrease of the moon. The days of the month are pointed out by a statue; the hours of the day are announced by a golden cock, and struck on the bell by a figure representing an angel, while another turns an hour-glass as soon as the clock has finished striking. The quarters are also struck, the first by a child with an apple, the second by a youth with an arrow, the third by a man with a tip-staff, and the fourth by an old man with a cane.

[c] *Orleans* is named after the Emperor *Aurelian*, who founded, or rather rebuilt it.

[d] The canal of Languedoc, which connects the Mediterranean with the Atlantic, is 150 miles long, 60 feet broad, and 6 feet deep. It is one of the great works of the reign of Louis XIV.

FOREIGN POSSESSIONS.—In the West Indies, Martinique, Guadaloupe, Marie Galante, and the northern part of St. Martin; in South America, Cayenne; in Africa, Algiers, Senegal, and the Isle of Goree; in the East Indies, Pondicherry and Chandernagore; in the Indian Ocean, Bourbon; and in the Pacific Ocean, the Marquesas, &c.

CLIMATE, SOIL, SURFACE.—France enjoys one of the finest *climates* in Europe; its *soil* is generally fertile: and its *surface* is, for the most part, level, or slightly undulating It abounds in vineyards;[a] and in the south, it produces olives, figs, and oranges.

The principal PRODUCTIONS are wines,[b] brandy, grain, oil, and fruits; and its chief manufactures are silks, woollens, porcelain, jewellery, plate-glass, cotton, and laces. Its COMMERCE is very extensive, but greatly inferior to that of the British empire. The MINERALS of France are of considerable importance. See page 176.

The established RELIGION is Roman Catholic, but all others have full toleration; and Protestant clergymen are supported by the state.

The GOVERNMENT is a limited monarchy. See page 177. In POWER and political importance France ranks next to the British empire.[c]

In LITERATURE and SCIENCE France has long held a distinguished rank; but till the present reign the education of the great body of the people was almost entirely neglected. Since 1833, an organized and extensive system of popular education has been in operation under the control of the government.

The French are a brave, lively, intelligent, and ingenious people; and are noted for their politeness and attention to strangers.

HISTORICAL SKETCH.

France was originally peopled by the ancient *Celts*, whom the Romans called *Gauls*. It was conquered by Julius Cæsar about 60 years B.C.:

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[a] Its vineyards cover about 5 millions of acres; and the woods and forests, which supply most of the fuel used in France, occupy about 17½ millions of acres.

[b] The wines of France, particularly those of Burgundy, Champagne, and the claret of Bordeaux, are the most esteemed of any in Europe.

[c] If the naval power of France were equal to its military, it would be the most powerful country in the world. Its standing army, in the zenith of Napoleon's power, amounted to 1,200,000 men; and its fleet to 73 ships of the line, 67 frigates, and a large number of smaller vessels. The naval power of France was, however, almost annihilated by Britain. From the commencement of the Revolutionary war to the Peace of Paris in 1814, we took or destroyed 97 of their line-of-battle ships, 219 frigates, and large numbers of smaller vessels.

The French army, in 1842, amounted to 344,000 men, and the navy to 46 ships of the line, 47 frigates, and several smaller vessels. Both forces, particularly the navy, have been increased since. The annual REVENUE amounts to about £45.000 000 and it continued to form a part of the Roman empire till it was subdued by the *Franks*, under Clovis, who gave it its present name. Clovis was the first king of France, and under him Christianity became the religion of the state. In the year 800, the celebrated *Charlemagne* or Charles the Great, was crowned Emperor of the West. His conquests extended over Spain, Germany, and the greater part of Italy. But soon after his death, the German empire was separated from France. In 912, the Normans or Northmen (from *Norway*), subdued, and settled in a part of France (Neustria), to which they gave its present name, *Normandy*. It was the descendants of the same people who, in 1066, achieved the conquest of England, under William Duke of Normandy.

In 987, Hugh Capet supplanted the reigning family, and became the founder of the third race of French kings. Among the succeeding events in French history may be mentioned the wars with Edward III. and Henry V. of England, which proved most disastrous to France. In the former wars, John, the French monarch, was made prisoner; and the result of the latter was, that Henry was declared heir to the crown of France (in 1420), and on his death, his son, Henry VI., was proclaimed king of it. In a few years after, the French, headed by the celebrated *Joan of Arc*, gained several battles over the English; who, though they were again victorious, were obliged soon after to retire from the country (in 1450). In 1597, Henry IV., King of Navarre, the first of the house of Bourbon, ascended the throne of France. This great and good prince was assassinated in 1608. Louis XIV. began to reign in 1643, at the age of five years. During his long and prosperous reign, France made great advances in science and literature, and attained a high rank among the nations of Europe. In 1789 the ancient government was overturned by one of the most sanguinary revolutions on record. The king, Louis XVI., was beheaded in 1793, and a republic established, which was in its turn subverted, and General Bonaparte, a Corsican, became the supreme ruler of the nation, under the title of First Consul, in 1799, and in three years after (1802), he became Emperor. The events since that period are well known.

RUSSIA.

BOUNDARIES.—Russia is bounded on the north by the Arctic Ocean; on the west by Sweden, the Baltic, Prussia, Poland, and Austria; on the south by Turkey, the Black Sea, the Sea of Azov, and the Caucasian Mountains; and on the east by the Caspian Sea, the Ural River, and the Ural Mountains.[a]

Russia extends from 44° to 70° N.L., and from 21° to 60° E.L. Its length, from the southern extremity of the Crimea to the Arctic Ocean, is 1,700 miles; and its breadth from the Ural Mountains to the Baltic 1,500 miles. Its AREA[b] or superficial extent is about 2 millions of square miles; and its POPULATION in 1840 was 55,261,967.

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[a] See note on the eastern boundaries of Europe, page 170.

[b] This is its estimated extent in *Europe*, but, in addition to this, it comprises the whole of northern Asia, and a large portion of the north-west part of North America (from Behring's Straits to the meridian of 140° W.L. In fact,

Russia occupies more than the half of the whole continent of Europe. It comprises the greater part of the ancient kingdom of Poland, Finland, East Bothnia, part of Lapland, the Crimea or Taurida, Bessarabia, and part of Moldavia.

DIVISIONS.—Russia is divided into about 50 provinces or governments, ten of which formerly belonged to the crown of Poland.

The great divisions of Russia are, Russia Proper, Polish Russia, Finland, and Lapland, and that of the Don Cossacs.

Russia Proper is by far the most populous. It includes the governments of St. Petersburg, Moscow, Riga, Revel, Smolensk, Wilna, Archangel, Novogorod, and several others.

Polish Russia comprises about three-fourths of the ancient kingdom of Poland.

Finland was formerly a Swedish province, but it was, with a part of Lapland, ceded to Russia in 1809.

The Cossacs inhabit the shores of the Black Sea, and the mouths of the rivers Don, Ural, and Dniester. They are divided into several tribes, as the Don Cossacs, the Uralian Cossacs, and are now entirely subject to Russia.

CHIEF TOWNS.—The chief towns are Petersburg, Moscow, Riga, Odessa, Cronstadt, Archangel, Revel, Kherson, Kaffa; Warsaw and Cracow, in Poland; and Abo, in Finland.

PETERSBURG,[a] the capital, founded by Peter the Great, is one of the finest and most commercial cities in Europe. It is divided into two parts by the Neva. *Moscow*,[b] the ancient capital, is the great emporium of the inland trade of the empire. *Riga* has a fine harbour, and is strongly fortified. It ranks next to Petersburg in commerce. *Odessa* is one of the best and most frequented ports in the Black Sea. *Archangel* is the most northern port in Europe of any consequence, and was the principal one in Russia till Petersburg was founded. It carries on a considerable trade during the summer, but its harbour is frozen during the greater part of the year. *Kherson* has declined in consequence of the preference given to Odessa. It was here that the philan-

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this huge empire extends over more than an eighth of the whole land on the surface of the globe; but by far the greatest portion of it is uninhabited, and, it might be added, *uninhabitable;* for far the greatest part of it seems destined to perpetual sterility. The whole extent may be estimated at about 6 millions of square miles, and its population at about 62 millions. Of its population about 56 millions belong to Europe, nearly 6 to Asia, and between 60,000 and 70,000 to America.

[a] The population of Petersburg is about 470,000; of Moscow, 380,000; of Riga, 71,000; of Odessa, 70,000; of Cronstadt, 36,000; of Sevastopol, 30,000; of Archangel, 20,000; and of Abo, 12,000.

[b] *Moscow.*—This magnificent city was set fire to by its inhabitants when occupied by the invading army of the French, under Napoleon, in 1812; and two-thirds of it were destroyed. The Kremlin, which contains the ancient palace of the Czars, escaped the conflagration. The city has since been, in a great measure, rebuilt, and with increased splendour.

thropic Howard died. *Cronstadt*, the principal station of the Russian navy, is on a small island, 22 miles from Petersburg, the passage to which it commands. It is strongly fortified. *Sevastopol* is the principal naval station in the Black Sea. *Abo*, the capital of Finland, has a considerable trade, and is the seat of a university.

MOUNTAINS.—The Ural Mountains, the Olonetz Mountains, and the Valdai Hills.

RIVERS.—The principal rivers are the Volga, the Don, the Dnieper, the Dniester, the N. Dwina, the S. Dwina, and the Memel or Niemen.

LAKES.—Ladoga, Onega, Ilmen, &c.

ISLANDS.—In the Baltic, Aland, Dago, Oesel; in the Arctic Ocean, Nova Zembla, Spitzbergen, &c.

GULFS, BAYS, STRAITS, &c.—The gulfs of Bothnia, Finland, and Riga; Archangel Bay, Onega Bay; Straits of Kaffa or Yenikale, and the Straits of Waygatz.

Russia, from its vast extent, is subject to great diversity ol SOIL and CLIMATE; but, generally speaking, except in its southern provinces, which are exceedingly fertile, it is a cold and unproductive country.

The SURFACE is generally level, and a great portion of it, particularly towards the north, is covered with lakes, marshes, forests, and barren plains, called *steppes*.

The PEOPLE are rude and uneducated, but great efforts are now making to instruct and civilize them. The great majority of the PEASANTS are still in a state of vassalage to the proprietors of the soil.

The principal PRODUCTIONS of Russia are timber, tar, pitch, tallow, corn, hemp, flax, iron, copper, furs. It also produces gold, platina, and precious stones. See page 175.

Its MANUFACTURES are still in a backward state, but great efforts are making to improve those which they have, and to introduce others.

The ESTABLISHED religion is the Greek Church, but all others have full toleration. The GOVERNMENT is an absolute monarchy. Peter the Great was the founder of this vast empire.

HISTORICAL SKETCH.

Russia, anciently *Sarmatia*, is supposed to derive its name from the *Rossi*, a Slavonic tribe, of whom mention is made in the histories of the ninth century. It was successively occupied by the Scythians, Goths, Vandals, Huns, and the other barbarians, who advanced upon, and ultimately overran the Roman empire. In 862, Ruric, a Scandinavian, having united together the independent states or tribes who possessed the country, became the first monarch of Russia. In 976 Vladamir embraced the religion of the Greek Church,* and introduced it among his subjects, who had previously been Pagans. About the year 1237, Batto, Khan of the Mongols, took possession of the empire, and for the space of more than two centuries and a half it remained in a state of subjection to him and his successors. But the independence of the empire was re-established by Ivan Basilovitch, who subdued Astrakan and other Tartar provinces. In 1696, Peter the Great, by the death of his brother Ivan, became sole monarch of Russia. He assumed the title of Emperor of all the Russias;[a] and it is to this great prince that the present power of Russia is principally due. Before his time the Russians were little better than barbarians. The extraordinary efforts which he made to introduce civilization among them, and to increase and consolidate the power of the empire are well known.

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* Through the instrumentality of the Greeks of Constantinople.

POLAND.

Boundaries.—Poland, before its dismemberment, was bounded on the north by the Baltic and Prussia; on the west by Germany; on the south by Hungary and Turkey; and on the east by Russia.

It extended from about 48° to 58° N.L.; and from 15° to 33° E.L. Its length from east to west was about 700 miles; and its breadth from north to south, 600 miles. Its area was about 250,000 square miles, and its population nearly 15,000,000.

Divisions.—Poland comprised three great provinces or governments, which were subdivided into 32 palatinates. The three great provinces were Great Poland in the north-west, Lithuania in the north-east, and Little Poland in the south.

Chief Towns.—Warsaw, Cracow, Dantzic, Thorn, Elbing Leopold or Lemberg, Grodno, &c.

Rivers.—The Vistula, the Memel or Niemen, the Dwina, &c.

Mountains.—The Krapack or Carpathian Mountains, between it and Hungary.

Partition of Poland.—Russia obtained the provinces of Courland, Samogitia, Lithuania, Masovia, Polesia, Volhynia, Ukraine, and Podolia. To *Prussia* fell Polachia, Polish Prussia, and Great Poland; and to *Austria*, Galicia.

The present Kingdom of Poland consists principally of the Grand Duchy of Warsaw, which was established by Napoleon in 1807. The sovereignty of it was assigned to Russia by the Congress of Vienna in 1814. Its extent in square miles is about 50,000; and its population amounts to about 4½ millions. The capital is Warsaw.

The small Republic of Cracow is under the protection of Russia, Austria, and Prussia Its area is 488 square miles;

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[a] "All the Russias" refers to the countries called Russia Proper, Red Russia, White Russia, and Black Russia.

and its population about 132,000, of which about 38,000 live in Cracow, the capital.—See note, p. 178.

AUSTRIA.

BOUNDARIES.—Austria is bounded on the north by Saxony, Prussia, and Poland; on the west by Bavaria, Switzerland, and Piedmont; on the south by Turkey, the Adriatic, and the Italian states; and on the east by Russia and Turkey.

It extends from 44° to 51° N.L., and from 8° 30′ to 26° 30′ E.L. Its length from east to west is about 850 miles; and its breadth from north to south, 480 miles. Its AREA is upwards of 250,000 square miles, and its POPULATION is nearly 37 millions.[a]

Austria comprises the archduchy of Austria, the kingdoms of Bohemia and Hungary, the provinces of Galicia, Moravia, Transylvania, the Tyrol, Styria, Carinthia, Sclavonia, Croatia, and Dalmatia; also the kingdom of Lombardy, and the states of Venice, in the north of Italy.—See note, p. 178.

It is the largest empire in Europe, except Russia, and it comprises under it several nations, which differ in language laws, customs, and manners.

DIVISIONS.

	Provinces.	Chief Towns.	Population in 1838.
Germans.	Lower Austria,	Vienna.	326,350
	Upper Austria,	Linz.	23,310
	Tyrol,	Inspruck.	10,730
	Styria,	Gratz.	39,770
Slavonians.	Carinthia,	Klagenfurt.	12,000
	Carniola,	Laybach.	13,000
	Illyrian Coast,	Trieste.	44,530
	Bohemia,	Prague.	102,918
	Moravia, and	Brunn.	86.700
	Silesia,	Troppau.	12,550
	Galicia,	Lemberg.	54,960
	Dalmatia,	Zara.	6,461
	Hungary, including	Pesth and Buda.	104,600
	Slavonia and	Esseck.	12,000
	Croatia,	Agram.	17,000
	Magyars,[a] Transylvania,	Clausenburg.	14,500
Italians.	Lombardy, and	Milan.	150,900
	Venice,	Venice.	97,150

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[a] Of the entire population of Austria, about 18,500,000 are Slavonians; 6,000,000 Germans; 4,500,000 Magyars or Hungarians; 4,400,000 Italians; 900,000 Wallachians; 150,000 Armenians, Albanians, &c.; and 600,000 Jews.

[a] The Magyars are the ancient inhabitants of Hungary, but they are now principally confined to Transylvania. They are of Tartar origin.

CHIEF TOWNS.—*Vienna*, the capital of the empire, holds a high rank among the cities of Europe for science, literature, and refinement. *Prague* is the capital of Bohemia, and the second city in Austria. *Presburg* is the ancient, and *Buda* is the modern capital of Hungary. *Pesth* and *Buda*, which are merely separated by the Danube, may be regarded as forming one city. *Lemberg* or *Leopold*, is the capital of Galicia, in Austrian Poland, and the centre of its trade. *Trieste* has a spacious harbour, and an extensive commerce; and for a long period was the only port in the Austrian empire. *Trent* is noted as the place where the last General Council was held. *Saltzburg*, in Upper Austria, is famous for its *saltworks*, from which it derives its name. *Tokay*, on the Theiss, is famous for its wine; and *Kremnitz* and *Shemnitz* for their gold and silver mines.

Venice has declined from her former power and opulence, but is still a magnificent city. *Milan*, the ancient capital of Lombardy, is a large and magnificent city, with numerous manufactures, and an extensive trade.

MOUNTAINS.—The Carpathian Mountains, between Hungary and Galicia; the Sudetic Mountains, north of Bohemia; and the Tyrolese Alps, north of Lombardy.

RIVERS.—The Danube, with its tributaries, the Inn, the Drave, and the Save, on its right bank; and the Theiss, &c on its left; and in Italy, the Po, the Adige, Brenta, &c.

LAKES.—Cirknitz in Carniola, Platten See in Hungary; Maggiore, Como, and Garda, in Italy.

The CLIMATE of Austria is, generally speaking, mild and salubrious; and the SOIL, for the most part, fertile, but badly cultivated. Few countries can vie with it in the number and richness of its mines; as the gold and silver of Hungary, the iron of Carinthia and Styria, the copper, iron, and lead, of Galicia, the quicksilver of Carniola, and the celebrated salt mines near Cracow.[a]

A great part of the SURFACE is mountainous, particularly in Styria, Carinthia, and Carniola; but in Hungary and Austrian Poland there are immense plains.[b]

AGRICULTURE is in a backward state; and COMMERCE, owing to the small extent of the sea coast, is necessarily limited; and the MANUFACTURES are neither numerous nor important.

The prevailing, and established RELIGION is Roman Catholic, but all others are tolerated.

The MILITARY force of the empire is about 300,000, and can be greatly increased in the event of a war; but the NAVAL force is insignificant.

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[a] See note on the minerals of Europe, page 175.

[b] See page 65, and note.

The annual REVENUE is estimated at about £17,000,000; and the public DEBT is about £60,000,000.

The manners of the Austrians differ little from those of their German neighbours; but in literature, and general information, they are inferior to most of the German states. The Hungarians are a brave and high-spirited people, but indolent and prejudiced.

HISTORICAL SKETCH.

The Archduchy of Austria formed a part of the ancient *Pannonia*, the *Vindobona* of the Romans being the modern Vienna. *Noricum*, and the country of the *Quadi*, were the Roman names of the other parts of Austria. It was called *Austria*, that is, the *eastern* kingdom with reference to France, under Charlemagne, who was crowned, in the year 800, Emperor of the West. Germany was ruled by French princes till 912, when Conrad, Count of Franconia, was elected king. Otho the Great conquered Bohemia and Italy, and in 962 assumed the title of Emperor of Germany and King of Italy. In 1273, Rodolph, Count of Hapsburg, the founder of the house of Austria, was raised to the Imperial throne. In 1477, the Emperor Maximilian having married Mary, heiress of Charles Duke of Burgundy, the Netherlands became subject to the Austrian empire; and by the marriage of his son, Philip, with Jane, daughter of Ferdinand and Isabella of Spain, in 1496, the crown of Spain became attached to the house of Austria. In 1516, Charles V., grandson of Maximilian, succeeded to the throne of Spain, and in three years after to the Imperial crown. On his resignation, Spain and the Netherlands devolved to his son, Philip II.; and Austria, Bohemia, and Hungary, to his brother, Ferdinand, who was shortly after elected Emperor of Germany. In 1740, the male branch of the house of Austria became extinct by the death of Charles VI., and the right of his daughter, Maria Theresa, to the crown was disputed, in a war in which most of the powers of Europe were involved. This was terminated in 1748, in the Peace of Aix-la-Chapelle, when the right of Maria Theresa was acknowledged, and her husband was raised to the Imperial throne under the title of Francis I. In 1806, Francis II. was obliged by Napoleon, who conquered the most of his dominions, to resign the title of Emperor of Germany, and to take in its stead that of Emperor of Austria.

PRUSSIA.

BOUNDARIES.—Prussia is bounded on the north by Hanover and the Baltic; on the west by France, Belgium, and Holland; on the south by Austria and Saxony; and on the east by Russia and Poland.

It extends from about 49° to 56° N.L., and from 6° to 23° E.L. Its greatest length is about 750 miles; and its breadth varies from 80 to 350 miles. Its AREA is about 108,000 square miles; and its POPULATION in 1840 was 14,907,091.

DIVISIONS.—The Prussian monarchy is divided into eight provinces, which are subdivided into 25 regencies or governments. Each regency takes its name from the chief city within its bounds. The provinces are Prussia proper, Posen, Brandenburg, Pomerania, Silesia, Prussian Saxony, Westphalia, and Rhenish Prussia.

The sovereignty of Neufchatel, in Switzerland, also belongs to Prussia.

Provinces.	Chief Towns.	Population in 1838.
East Prussia, . . .	Konigsberg.	68,000
West Prussia, . . .	Dantzic.	56,257
Posen, ...	Posen.	32,456
Brandenburg, . . .	Berlin.	290,797
Pomerania, . .	Stettin.	31,100
Silesia, ...	Breslau.	90,000
Prussian Saxony, . .	Magdeburg.	52,000
Westphalia, . . .	Munster.	19,763
Rhenish Prussia, . .	Cologne.	67,000

CHIEF CITIES.—BERLIN, on the Spree, the capital of Prussia, and one of the most beautiful cities in Europe. *Potsdam*, a few miles from Berlin, is noted for its royal palace. *Dantzic*, *Stettin*, and *Konigsberg*, are noted for their extensive commerce. *Halle* is famous for its university. *Frankfort*, on the Oder, has important manufactures, and extensive commerce. *Cologne* is the principal seat of commerce on the Rhine, and is celebrated for its cathedral. It is here that the famous Eau de Cologne is made. *Aix-la-Chapelle*, 30 miles west from Cologne, is noted for two important treaties of peace concluded there, and also for its baths. *Coblentz* is situated at the confluence of the Rhine with the Moselle, and is the great depot for the Rhenish wines. *Dusseldorf*, a large handsome town, at the confluence of the Dussel with the Rhine.

The *sea-ports* are Dantzic, Konigsberg, Stettin, Memel, Elbing, Stralsund, Colberg, and *Pillau*, which may be regarded as the port of Konigsberg, and Elbing.

RIVERS.—The principal rivers are the Rhine, the Elbe, and the Weser, flowing into the German Ocean; and the Vistula, Oder, and Memel or Niemen, into the Baltic.

GULFS.—The Gulf of Dantzic, at the mouth of the Vistula; Frische-Haff, which is separated from the Gulf of Dantzic by a long narrow peninsula; Curische[a]-Haff, an inlet of the same kind, at the mouth of the Memel; and Gross-Haff, at the mouth of the Oder.

ISLANDS.—Rugen, in the Baltic

The SURFACE of the Prussian states is generally flat. The mountain-tracts are the Hartz in Saxony, and the Riesengebirge on the south-west confines of Silesia. The SOIL in general is poor, particularly in Brandenburg and Pomerania, large portions of which consist of sandy steppes, and barren heaths. Rhenish Prussia and Silesia are the most fertile provinces.

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[a] *Curische-Haff*, that is, the *haven* of *Courland*.

The CLIMATE in the *western* or Rhenish provinces is *mild;* in the Baltic or northern, *moist;* and in the *eastern*, or the parts near Russia and the Carpathian Mountains, *cold.*

Prussia is not rich in MINERALS,[a] but *iron* is abundant, and extensively worked in the Rhenish provinces, and Silesia. *Coal* is also abundant in the Rhenish provinces, Saxony, and part of Silesia. *Copper* also is found in considerable quantities. *Amber* has long been known as a product of Prussia. It is found principally along the low tongue of land between the Curische-Haff and the sea.

The COMMERCE of Prussia is considerable. The principal exports are corn, wool, timber, iron, flax, linen, and woollen cloths, Westphalia hams, &c.

EDUCATION.—Prussia can boast of possessing the most complete and best organized system of national education existing in Europe. In fact, the whole people may be said to be educated; for if parents fail to send their children to the schools established by the state, they must satisfy the authorities that they are receiving a suitable education at home, or in private seminaries. In addition to numerous Normal schools and academies, there are seven universities, namely, those of Berlin, Breslau, Halle, Bonn, Konigsberg, Munster, and Griefswald.

Since the time of Frederick the Great, much attention has been devoted to MILITARY tactics; and, in fact, it is to the great number, high discipline, and well-known bravery of her soldiers that the power of Prussia is principally due. At present the regular army amounts to 122,000, and the *landwehr* or militia to 430,000. Prussia has no NAVAL force.

The RELIGION is Protestantism, but all denominations of Christians have perfect toleration, and are equally eligible to places of trust and emolument.

The Prussians being composed of different races, present a great variety in their characters and customs, but, in general, they are like their German neighbours.

HISTORICAL SKETCH.

Prussia is supposed to derive its name from the *Pruzzi*, a Slavonic tribe, who occupied the country after the Goths. The Pruzzi were, in 1227, subdued by the Teutonic Knights, who, when the Crusades in Palestine failed, waged war against the Pagans in the north of Germany. In 1466, the Teutonic Knights were obliged to yield the sovereignty of Prussia to Poland, which continued to possess it till 1656, when Frederick William, usually called the Great Elector, compelled the King of Poland to declare Prussia an independent state. In 1688, he was succeeded by his son, Frederick, who made himself King of Prussia in 1701, having put the crown upon his own head. His grandson, Frederick the Great, began to reign in 1740, who, by the energy of his character, and his extraordinary talents, both as a statesman and a warrior, raised Prussia to the rank of one of the "Five Great Powers of Europe."

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[a] *Minerals.* See page 175.

SPAIN.

Spain is bounded on the north by the Pyrenees and the Bay of Biscay; on the west by Portugal and the Atlantic; and on the south and east by the Mediterranean.

Its length from Cape Creux to the most western point of Galicia is 650 miles; and its breadth from the Bay of Biscay to the Straits of Gibraltar 530 miles. Its extent in square miles is estimated at 182,270; and its population amounts to nearly 13 millions.

DIVISIONS.—It is divided into 14 great provinces, which are subdivided into 49 smaller provinces or governments, each of which except four [a] takes its name from the chief town within its boundary.

FOUR NORTHERN PROVINCES.

Provinces.	*Chief Towns.*
Galicia,	Santiago, Corunna, Ferrol, Vigo.
Asturias,	Oviedo, Santander, Gijon.
Biscay,	Bilboa, Vittoria, St. Sebastian.
Navarre,	Pampeluna, Tudela, Estella.
FOUR EASTERN PROVINCES.	
Arragon,	Saragossa, Teruel, Jacca.
Catalonia,	Barcelona, Tortosa, Tarragona.
Valencia,	Valencia, Alicant, Murviedro.[b]
Murcia,	Murcia, Carthagena, Lorca.
FOUR MIDLAND PROVINCES.	
Leon,	Leon, Valladolid, Salamanca, Astorga.
Old Castile,	Burgos, Segovia, Avila.
New Castile,	MADRID, Toledo, Talavera.
Estremadura,	Badajos, Merida.
TWO SOUTHERN PROVINCES.	
Granada,	Granada, Malaga, Almeria.
Andalusia,	Seville, Cadiz, Cordova, Xeres,[c] Gibraltar.[d]

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[a] Namely, Navarre, Biscay, Alava, and Guipuscoa, which retain their ancient denominations. Their chief towns are Pampeluna, Vittoria, Bilboa, and St. Sebastian.

[b] *Murviedro* is on the site of the ancient *Saguntum.*

[c] *Xeres.*—Hence *sherry* wine takes its name.

[d] See page 219.

CHIEF TOWNS.—*Madrid* is important only as the capital of the Spanish monarchy. It is situated on a plateau about 2,000 feet above the level of the sea. *Barcelona* is the second city in Spain for population and the first in commerce, manufactures, and wealth. *Seville* was formerly the capital of Spain, and is still a large and handsome city. *Cadiz*[a] is next in commercial importance to Barcelona; and is the chief station of the Spanish navy. *Valencia* is celebrated for its manufactures, and has a considerable trade, though it can scarcely be said to have a harbour. *Granada* was the capital of the Moorish kings, and contains the celebrated Alhambra. *Carthagena* is a flourishing port, and is said to have been built by Asdrubal, the Carthaginian general. *Saragossa*, the ancient *Cæsarea Augusta*, is famous for its resistance to the French in 1808-9. *Malaga* is a large and important commercial town, with a capacious harbour. *Corunna* is noted for its safe and spacious harbour; and is the chief packet station for England, &c. *Ferrol* is an important naval station. Its harbour is unrivalled in Europe for extent, depth, and safety. *Murcia, Cordova, Badajoz*, and *Toledo*, are among the most distinguished ancient cities. *Salamanca* has long been celebrated for its university. *Gibraltar*, one of the strongest fortresses in the world, has belonged to Britain since 1704.

ISLANDS.—The Balearic Islands, Majorca, Minorca, and Iviza; and the Canary Islands.

Palma in Majorca, and *Port Mahon* in Minorca, are the principal towns in the Balearic Islands. *Santa Cruz*, in Teneriffe, is the capital of the Canary Islands.

MOUNTAINS.—The Pyrenees, Santillanos or Mountains of Biscay and Asturias, the Mountains of Castile and Toledo, Sierra Morena, Sierra Nevada, and Montserrat.

RIVERS.—The Minho, Douro, Tagus, Guadiana, Guadalquiver, flowing into the *Atlantic;* and the Ebro, Xucar, and Segura, into the *Mediterranean.*

COLONIES.—Almost the only remains of the vast foreign possessions of Spain are Cuba and Porto Rico, in the West Indies; and the majority of the Philippine Isles, in the Indian Archipelago.

Next to Switzerland, Spain is the most mountainous country in Europe. It is traversed from east to west by several rugged chains, and its centre, comprising a large portion of the two Castiles, consists of an extensive plateau or table land, nearly 2,000 feet above the level of the sea. It abounds in fertile and beautiful valleys and in grand and picturesque scenery. Its CLIMATE is, generally speaking, very hot, but dry and healthy. In the elevated regions it is cool and pleasant in summer, but very cold in winter. In the north, and about the sea-coast, it is mild and agreeable. The SOIL is in general very fertile, but badly cultivated.

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[a] *Cadiz* has declined greatly since the defection of the Spanish American colonies.

Spain was known to the ancients by the names of *Hispania* and *Iberia*. It was also, from its *western* situation, called *Hesperia*.

HISTORICAL SKETCH.

Spain, it is supposed, was originally peopled by the *Iberians* and other Asiatic tribes, traces of whose race and language exist to this day in the Basque Provinces. The Phœnicians at a very early period established colonies in it as *Gades* (Cadiz), and the Carthaginians subsequently took possession of a great part of it. The Romans drove the Carthaginians from it, and ultimately converted it into a province of their empire.

Upon the breaking up of the Roman Empire it was taken possession of by the Vandals, Suevi, and Alans; and subsequently, by the Visigoths or *Western* Goths (in 477), who erected it into a very powerful kingdom, which existed till the invasion and conquest of the country by the Saracens or Moors in 713. The Moors overran all Spain, except the northern provinces and mountainous districts, and their descendants kept possession of the best part of the country for nearly 800 years. They were finally conquered and driven from Spain by Ferdinand and Isabella (in 1492).

PORTUGAL.

Portugal is bounded on the north and east by Spain, and on the west and south by the Atlantic.

Length, from north to south, 350 miles; breadth, from the Rock of Lisbon to the borders of Spain, 140 miles. Extent in square miles about 36,000. Population about 3½ millions.

Portugal is divided into six provinces, which, with their principal towns, are as follows:—

Provinces.	*Chief Towns.*
Entre Douro e Minho,	Oporto, Braga, Viana.
Tras-os-Montes,	Braganza, Miranda, Villa Real.
Beira,	Coimbra, Almeida, Castelbranco.
Estremadura,	LISBON, Setuval or St. Ubes, Santarem, Cintra, Vimieiro.
Alentejo,	Evora, Elvas.
Algarve,	Faro, Tavira, Lagos.

CAPES.—Mondego, Roca or the Rock of Lisbon, St. Vincent, St. Mary.

MOUNTAINS.—Sierra d'Estrella, in Beira and Estremadura.

RIVERS.—Minho, Douro, Mondego, Tagus, Guadiana.

COLONIES.—The Cape Verde Islands, the Azores, the Madeiras; and settlements in Angola, Benguela, and Mozambique, in Africa; also Goa, in the East Indies, and Macao, near Canton.

The ancient name of Portugal was *Lusitania*, but the boundaries are somewhat different. Its present name is derived from an ancient town on the Douro, near the site of *Oporto*, called *Calle*. It implies the *Port* of *Calle*, or the *western* port. See note, p. 203.

ITALY.

ITALY is bounded on the north by the Alps, which separate it from Switzerland and Austria; on the west by France and the Mediterranean; on the south by the Mediterranean; and on the east by the Adriatic.

Length, from Cape Leuca to Mont Blanc, about 700 miles; breadth, except in the northern portion of it, not much above 100 miles.

Italy comprehends nine sovereign and independent states. In the *south*, the Kingdom of Naples, which includes the Island of Sicily;[a] in the *middle*, the Ecclesiastical States, or territories of the Pope; in the *north-west*, Piedmont, Savoy, and Genoa, which, with the Island of Sardinia, constitute the Kingdom of Sardinia; and in the *north-east*, or between the Po and Ticino, the Gulf of Venice and the Alps, is Austrian Italy or the Lombardo-Venetian States. The Duchies of Tuscany, Lucca, Modena, and Parma, lie between the Sardinian and Ecclesiastical States. The small republic of San Marino is within the Ecclesiastical States; and the petty principality of Monaco is within the Sardinian.

Kingdom of Naples.	*Chief Towns.*
Naples,	NAPLES, Barri, Reggio, Taranto, Salerno, Gaeta, Brindisi.
Sicily,	Palermo, Messina, Catania, Girgenta, Trapani, Syracuse.
Kingdom of Sardinia.	
Savoy,	Chamberry.
Piedmont,	TURIN, Nice, Alessandria.
Genoa,	Genoa, Savona.
Island of Sardinia,	Cagliari, Sassari.
Austrian Italy.	
Milan,	MILAN, Mantua, Cremona, Pavia, Lodi.
Venice,	VENICE, Verona, Padua, Vicenza.
States of the Church,	ROME, Bologna, Ferrara, Perugia, Ancona, Ravenna, Civita Vecchia, Tivoli, Loretto.
Tuscany,	FLORENCE, Leghorn, Pisa, Sienna.
Lucca,	Lucca.
Modena,	Modena, Massa, Carrara, Reggio.
Parma,	Parma, Piacenza.
Principality of Monaco,	Monaco.
Republic of San Marino,	St. Marino.

CHIEF TOWNS.—*Rome*, once the capital of the world, is still a magnificent city. Its splendid buildings and architectural ruins are every where celebrated. *Naples* surpasses every city in Europe for the beauty of its appearance and situation. *Turin* is a handsome city in a fine situation, and is noted for its silk manufactures. *Florence* is a beautiful city, and distinguished as a seat of science and art; and for its noble collection of paintings and statues. *Genoa*, formerly the capital of a republic of the same name, is one of the most commercial ports in Italy. *Leghorn* is next to *Genoa* in commercial importance. *Bologna* is the second city in the Roman States, and is famous for its sausages. *Ancona*, in the same states, has a good harbour, and considerable trade.

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[a] The Kingdom of Naples is sometimes called the Kingdom of the Two Sicilies.

Milan and *Venice*, in Austrian Italy, are large and magnificent cities. And there are many other large and noble cities in Italy; as Padua, Verona, Mantua, Modena, &c.

ISLANDS.—Besides Sicily and Sardinia, already mentioned, there are Malta, Corsica, Elba, and the Lipari Isles.

The chief towns of Corsica are, Bastia, Ajaccio, and Bonifacio; and the capital of Malta is Valetta.

GULFS.—Venice, Genoa, Salerno, Taranto, &c.

STRAITS.—Messina, Bonifacio, Otranto.

CAPES.—Passaro, Spartivento, Leuca, Colonne.

MOUNTAINS.—Alps, Apennines, Vesuvius; and, in Sicily, Mount Etna.

RIVERS.—The Po, Adige, Ticino, Arno, Tiber, Volturno.

LAKES.—Maggiore, Lugano, Garda, Como, &c.

Italy is a mountainous, but a rich, beautiful, and picturesque country. Its climate is delightful, and its sky clear and unclouded. The heat, however, in many places is very oppressive in summer; and the *malaria* at that season renders large tracts of it uninhabitable; as the Tuscan Maremme, the Pontine Marshes, and the Campagna di Roma. The south of Italy is subject to the sirocco from Africa. See page 95.

SWITZERLAND.

SWITZERLAND is bounded on the north by Germany; west by France; south by Italy; and east by Austria.

Its length, from Mount Jura to the Tyrol, is about 200 miles; and its breadth, from Como to the Rhine at Schaffhausen, is 130 miles. Its area in square miles is about 15,000; and its population amounts to about 2,130,000.

Switzerland consists of 22 CANTONS, which are united into one political body called the Swiss Confederation.

Cantons.	*Chief Towns.*	*Cantons.*	*Chief Towns.*
Basle or Bâle,	Basle.	Geneva, . .	Geneva.
Argovia, . .	Aarau.	Pays-de-Vaud,	Lausanne.
Zurich, . .	Zurich.	Neufchatel,[*] .	Neufchatel.
Schaffhausen, .	Schaffhausen.	Friburg, . .	Friburg.
Thurgovia, .	Frauenfeld.	Berne, . .	BERNE.
St. Gall, . .	St. Gall.	Soleure, . .	Soleure.
Appenzell, .	Appenzell.	Lucerne, . .	Lucerne.
Unterwalden, .	Stantz.	Glarus, . .	Glarus.
Uri, . . .	Altorf.	Valais, . .	Sion.
Zug, . . .	Zug.	Grisons, . .	Coire.
Schweitz, . .	Schweitz.	Ticino or Tessin,	Lugano.

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[*] The sovereignty of Neufchatel belongs to Prussia.

CHIEF TOWNS.—*Berne* is the chief town of the largest canton, and is usually regarded as the capital of the whole. The diet sits there, and also at *Lucerne* and *Zurich* in rotation. *Geneva* is beautifully situated on the lake of the same name, and is celebrated for its literary institutions and the distinguished men it has produced. *Basle* or *Bâle* and Zurich are two of the most commercial towns. *Lausanne* is an interesting town on the side of the Alps, about 1,000 feet above the level of the sea. *Schaffhausen* is near the celebrated fall of the Rhine, and is noted for its trade.

MOUNTAINS.—The Alps, the loftiest summits of which on the Swiss side are Mount Rosa, Mount Cervin, Jungfrau, Schrekhorn, Great St. Bernard, the Simplon, St. Gothard, Mount Jura. Mont Blanc is in the neighbourhood of Switzerland (between Savoy and Piedmont).

RIVERS.—The Rhine, Rhone,[a] Aar, Ticino, Inn, &c.

LAKES.—Geneva, Constance, Zurich, Lucerne, Neufchatel, Lugano, &c.

RELIGION.—In eight of the cantons the Roman Catholic religion is established; in seven, the Protestant; and in the remaining seven, both these forms of religion exist together.

LANGUAGE.—The Swiss speak French, German, or Italian, as they border on those several countries.

Switzerland is the most elevated and the most mountainous country in Europe, and has long been celebrated for the diversity, beauty, and sublimity of its scenery. Its lofty mountains, covered with eternal snow, and its glaciers or seas of ice, contrast beautifully with its fertile valleys, its picturesque lakes, and its crystal streams.

GERMANY.

GERMANY is bounded on the north by the German Ocean, Denmark, and the Baltic; on the west by France, Belgium, and Holland; on the south by Switzerland, and Italy; and on the east by Prussia, Poland, and Hungary.

It extends from about 45° to 55° N.L., and from about 6° to 20° E.L. Its length, from east to west is 620 miles; and its breadth, from north to south, 600 miles. Its area in square miles nearly 243,000. Population about 40 millions.

Germany is divided into 38 distinct and independent states, which are united under the name of the Germanic Confederation.[b] Austria is the principal state, and Prussia is the second; and the next in importance are, Bavaria, Wurtemberg, Hanover, Saxony, and the Grand Duchy of Baden.

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[a] The sources of the Rhine and the Rhone are but five miles apart. The former rises near Mount St. Gothard, and flows through Lake Constance; the latter has its source at the foot of Mont Furca, and flows through the Lake of Geneva.

[b] The object and obligations of the Germanic Confederation are to maintain internally and externally the independence and integrity of each of the German States.

GERMANIC CONFEDERATION.

States.	Extent in Eng. square miles.	Population.[a]	Contingent to the Army.[a]	Votes in full Diet.
Austria,	75,822	11,725,540	94,822	4
Prussia,	71,296	11,388,168	79,484	4
Bavaria,	29,638	4,370,977	35,600	4
Saxony,	5,766	1,706,276	12,000	4
Hanover,	14,776	1,755,592	13,054	4
Wurtemberg,	7,675	1,701,726	13,955	4
Baden,[1]	5,851	1,296,967	10,000	3
Hesse-Cassel, Electorate,	3,858	728,650	5,679	3
Hesse-Darmstadt,[1]	3,243	811,503	6,195	3
Holstein and Lauenburg,[2]	3,710	500,435	3,600	3
Luxemburg[1] and Limburg,	1,886	374,327	2,536	3
Brunswick,[2]	1,526	262,948	2,096	2
Mecklenburg-Schwerin,[1]	4,834	501,428	3,580	2
Nassau,[2]	1,802	406,713	4,039	2
Saxe-Weimar,[1]	1,421	251,980	2,010	1
Saxe-Coburg-Gotha,[2]	816	141,241	1,116	1
Saxe-Meiningen,[2]	933	152,640	1,150	1
Saxe-Altenburg,[2]	509	125,443	982	1
Mecklenburg-Strelitz,[1]	997	89,528	718	1
Oldenburg and Kniphausen,[1]	2,417	270,530	2,829	1
Anhalt-Dessau,[2]	318	62,603	529	1
Anhalt-Bernburg,[2]	297	46,252	370	1
Anhalt-Cöthen,[2]	254	41,020	325	1
Schwartzburg-Sondershausen,[3]	318	57,257	451	1
Schwartzburg-Rudolstadt,[3]	340	66,864	539	1
Hohenzollern-Hechingen,[3]	127	19,451	145	1
Lichtenstein,[3]	275	5,880	55	1
Hohenzollern-Sigmaringen,[3]	64	44,225	356	1
Waldeck,[3]	466	58,381	519	1
Reuss, Elder Branch,[3]	148	33,062	223	1
Reuss, Younger Branch,[3]	297	73,929	522	1
Schaumburg-Lippe,[3]	212	27,600	210	1
Lippe-Detmold,[3]	445	104,534	721	1
Hesse-Homburg, Landgravate,	106	23,689	200	1
Lubeck, Free Town,	127	46,744	407	1
Frankfort, ,,	43	66,338	693	1
Bremen, ,,	106	72,820	485	1
Hamburg, ,,	148	166,640	1,298	1
	242,867	39,580,001	303,493	70

The total number of votes in the diet is 70, but on ordinary occasions, only 17 votes are taken. Of these Austria, Prussia, Bavaria, Saxony, Hanover, Wurtemberg, Baden, Electorate of Hesse, G. D. of Hesse, Denmark (for Holstein and Lauenburg), and Holland (for Luxemburg), have each one vote; while the remaining six votes are partitioned among the Minor States, two or more of which must join in one vote. At the meetings of the diet, Austria presides, but has no greater power than the other members, except a casting vote when there happens to be an equality. When fundamental laws are to be made or altered, the diet resolves itself into a general assembly, in which each state votes individually, as represented in the foregoing table; and in which, a majority of two-thirds is required to accomplish any change.

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[1] Grand Duchy of. [2] Duchy of. [3] Principality of.

[a] From the Gotha Almanac for 1844.

The meetings of the diet are held at Frankfort on the Mayne, the capital of the Confederation.

The German dominions of Austria and Prussia are described under their respective heads. The following states are the next in importance.

States.	*Chief Towns.*
Kingdom of Bavaria,	MUNICH, Augsburg, Nuremburg, Ratisbon, Passau, Spires.
Kingdom of Wurtemberg,	STUTGARD, Ulm, Hailbron, Hall.
Kingdom of Hanover,	HANOVER, Hildsheim, Gottingen, Lunenburg, Osnaburg, Emden, Zell.
Kingdom of Saxony,	DRESDEN, Leipsic, Freyburg, Chemnitz.
Grand Duchy of Baden,	Carlsruhe, Manheim, Heidelberg.
Electorate of Hesse-Cassel,	Cassel, Hanau.
G. D. of Hesse-Darmstadt,	Darmstadt, Mentz, Worms.
Grand Duchy of Mecklenburg-Schwerin,	Schwerin, Rostock.
G. Duchy of Oldenburg,	Oldenburg.
Duchy of Nassau,	Wisbaden, Nassau.
Duchy of Brunswick,	Brunswick, Wolfenbuttel.
G. Duchy of Saxe-Weimar,	Weimar, Jena.
D. of Saxe-Coburg-Gotha,	Coburg, Gotha.

The united areas of the remaining German States amount to about 10,000 square miles, and their population to about a million and a half.

The most of the Minor German States resemble our COUNTIES in extent, population, and resources. They may be described as lying generally about the Mayne and the upper part of the Weser. They are confined on the north by Hanover, on the south by Bavaria and Baden, on the west by Rhine Prussia, and on the east by Prussia and Saxony. Mecklenburg-Schwerin lies on the Baltic, to the east of Holstein; and Mecklenburg-Strelitz to the south-east of Schwerin. Oldenburg lies to the west of the mouth of the Weser, within the kingdom of Hanover.

Of the free cities, Lubeck, Hamburg, and Bremen, are frequently called *Hanse Towns*, from a Teutonic word signifying a *league*. This league was formed in the thirteenth century by the chief commercial cities in Germany, in order to defend their property against the rapacity of the feudal lords; to clear the seas from pirates, and the highways from robbers. They were very powerful. Lubeck was the capital of the Confederation.

CHIEF CITIES.—In addition to the chief cities in Austrian and Prussian Germany may be mentioned *Munich*, the capital of Bavaria, a large and beautiful city. It contains splendid galleries of paintings and sculpture, and is distinguished for its literary institutions. *Dresden*, the capital of Saxony, is a beautiful city, and the seat of the arts in the north of Germany. It has extensive and elegant manufactures, especially of porcelain; and is distinguished for its royal library, museum, and gallery of pictures. *Stutgard* and *Hanover* are important only as the capitals of their respective kingdoms. *Carlsruhe*, the capital of Baden, is beautifully situated. It is built in the form of an outspread fan, or rather wheel, round the ducal palace, from which the streets issue, like the *radii* of a circle.

There are many other important and distinguished cities in Germany; as *Leipsic*, celebrated for its fairs,[a] its university, and the defeat of Napoleon by the Allies in 1813; *Augsburg*, where the Protestant Confession of Faith was presented to Charles V.; *Ulm*, formerly one of the imperial cities of Germany; *Heidelberg*, famous for its great tun, which holds 600 hogsheads; *Weimar*, distinguished for its library and literary establishments; *Gottingen*, in Hanover, celebrated for its university; *Gotha*, a beautiful city on the declivity of a hill, which is crowned by the palace of Friedenstein. It contains fine libraries, museums, and galleries of paintings; *Coburg*, a large and distinguished town; *Nuremberg*, a large and populous city; *Ratisbon*, an ancient and wealthy city,—with several others.

MOUNTAINS.—The Alps between Tyrol and Bavaria, the Hartz Mountains, Erzgebirge, Riesengebirge, Black Forest Mountains, &c.

RIVERS.—The Danube, Rhine, Elbe, Oder, Weser, Ems, Mayne, Necker, Iser, Inn, &c.

LAKES.—Boden See or Lake Constance, Schwerin, &c.

Germany may be divided into *Northern*, *Middle*, and *Southern*. In Northern Germany, particularly near the Baltic, the country is flat, and abounds in shallow lakes, marshes, and plains of sand. The SOIL is not generally very productive, and the CLIMATE is cold and moist.

Middle Germany is traversed by mountains of moderate height, which are rich in minerals. The SOIL is in general very productive; and the climate is so mild that the wine grape is cultivated in the valleys.

Southern Germany, south of the Mayne, is an elevated, hilly country, abounding in fertile and beautiful valleys. The principal productions are corn, wine, and minerals. The climate, except in the valleys, is not so mild as in Middle Germany.

DENMARK.

DENMARK is bounded on the north by the Skager Rack; on the west by the German Ocean; on the south by Germany; and on the east by the Cattegat, the Sound, and the Baltic.

Its length, from the Skaw to the Elbe, is 300 miles; and its breadth, from Copenhagen to the German Ocean, is about 180 miles. Its area in square miles is about 22,000; and its population, in 1840, was 2,135,730.

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[a] It has three fairs in the year, which last a fortnight each. They are attended by merchants from almost every country in Europe, and even from Asia; and at the Easter fair, by nearly 600 booksellers. It is the great emporium of the book trade in Germany.

Denmark is partly a continental, and partly an insular kingdom. Its continental territory consists of the peninsula of Jutland, and the Duchies of Sleswick, Holstein, and Lauenburg; and its principal islands are Zealand and Funen at the entrance of the Baltic. Holstein and Lauenburg form a part of the Germanic Confederation.

Divisions.	*Chief Towns.*
Jutland Proper, or North Jutland, ...	Aalborg, Aarhuus, Viborg.
Sleswick, or South Jutland,	Sleswick, Flensborg.
Holstein, ...	Kiel, Altona, Gluckstadt, **Rendsburg.**
Lauenberg, ...	Lauenburg, Ratzeburg.
Island of Zealand, . .	COPENHAGEN, Elsinore.
Island of Funen, . .	Odensee, Nyborg.

CHIEF TOWNS.—*Copenhagen*, the capital, and residence of the king, is situated on a fine harbour on the east coast of the island of Zealand. *Altona*, on the Elbe, ranks next in population and commerce. *Kiel*, the capital of Holstein, is celebrated for its university. At *Elsinore*, all ships passing through the Sound, are obliged to pay toll to the king of Denmark.

ISLANDS.—The other islands are Langland, Falster, Laaland, &c., in the Baltic; and the Faroe Isles, and Iceland in the Atlantic.

STRAITS.—The Sound, the Great Belt, and the Little Belt.

RIVERS.—The *Elbe*, which forms the southern boundary of Denmark; and the *Eyder*, which separates Holstein from Sleswick, and by means of the canal of Kiel connects the Baltic with the German Ocean.

CAPES.—The *Skaw*, in the north of Jutland.

FOREIGN POSSESSIONS.—The islands of St. Thomas, Santa Cruz, and St. John, in the West Indies; Tranquebar and Serampore in the East Indies; Greenland in the Arctic Ocean; and several forts and settlements on the coast of Guinea, in Africa.

Continental Denmark, and particularly Jutland, forms a long continued plain, with few elevations, or rising grounds. The small river *Eyder* is the only one of importance; but rivulets, brooks, and small lakes, are numerous. The *climate* is moist, but temperate, and generally healthy. The *soil* is in general fertile, and well adapted to pasturage; but in the north of Jutland there are larger barren tracts covered with heath and sand.

HOLLAND.

Holland[a] is bounded on the north and west by the German Ocean; on the south by Belgium; and on the east by Rhenish Prussia and Hanover.

Its length from north to south is 160 miles; and its breadth from east to west, 110 miles. Extent in square miles (including the Dutch portion of Luxemburg and Limburg) 13,600. Population in 1841, 3,054,396.

The kingdom of Holland is divided into 11 provinces:

Provinces.	*Chief Towns.*
North Brabant,	Bois-le-Duc, Breda, Bergen-op-Zoom.
Guelderland,	Arnheim, Nimeguen, Zutphen.
North Holland,	AMSTERDAM, Leyden, Haarlem, Alkmaar, Hoorn, Helder.
South Holland,	The Hague, Rotterdam, Delft, Dordrecht or Dort, Helvoetsluys, Briel.
Zealand,	Middleburg, Flushing, Campvere.
Utrecht,	Utrecht, Amersfort.
Friesland,	Leeuwarden.
Overyssel,	Zwoll, Deventer.
Groningen,	Groningen.
Drenthe (Drent),	Assen.
G. Duchy of Luxemburg,[b]	Luxemburg, Maestricht.

CHIEF TOWNS.—*Amsterdam*, the capital, on the *Amstel*, is one of the most commercial cities in Europe. The site of the city is marshy, and the houses are built on piles or timbers, driven deep into the earth. *Rotterdam* is next to Amsterdam in population and commerce. These cities are intersected in all directions by canals. The *Hague* is a beautiful city, and the seat of government. *Leyden* is celebrated for its university; and *Utrecht* is memorable for its treaties.[c] *Briel* or *Brielle*, is a handsome and strongly fortified town. The capture of the Briel is famous in Dutch history.

ISLANDS.—Walcheren, South Beveland, North Beveland, Schowen, Tholen, &c., which form the province of *Zealand;* and the Texel, Vlieland, Schelling, Ameland, &c., at the entrance of the Zuyder Zee.[d]

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[a] *Holland*, called also the *Netherlands*. See note, page 65.

[b] The Grand Duchy of Luxemburg is the German territory of Holland. It consists partly of Luxemburg, and partly of Limburg. It is detached from the other Dutch possessions, and is surrounded by Prussia, Belgium, and France. The western part of Limburg belongs to Holland, and is connected with it on the south-east.

[c] One in 1579, uniting the Seven United Provinces against the Spaniards; and another in 1713, terminating the wars of the Spanish succession.

[d] The Zuyder Zee was formerly a large inland lake (the *Flevo* of the ancients), through which the Rhine passed on its way to the ocean, between the islands of Vlieland and Ter Schelling; but, in the course of time, the sea made great inroads on the land, and at length totally submerged all that part of the country which joined the province of Holland to those of Guelderland and Overyssel.

SEAS AND BAYS.—Zuyder Zee, Haarlem Mer, Lauwer Zee, and Dollart Bay.

RIVERS.—The Rhine, with its branches, the Waal, Yssel, and Leck;[a] the Meuse or Maese, the Scheldt or Escaut, &c.

FOREIGN POSSESSIONS.—In the West Indies, Curaçoa, Buen Ayre, St. Eustatius, and part of St. Martin; in the East Indies, Java, and the Moluccas or Spice Islands; in South America, Surinam; and in Africa, El Mina, and several small forts on the coast of Guinea.

Holland, as its name implies, is a low flat country. In fact, the greater portion of it is below the level of the sea, from which it is only preserved by enormous dykes or embankments.[b] Viewed from an eminence, it presents the appearance of a vast plain, intersected by innumerable canals, which not only drain the country, but render it navigable in all directions. The tame monotony of the prospect is however relieved by the rich and verdant appearance of the country, interspersed with comfortable farm-houses, neat cottages, and elegant villas. The scene, too, is enlivened by the number of boats and ships which seem to be sailing through the country, amid trees and villages.

The CLIMATE in the south is mild, but in the north moist and foggy and in winter very cold. At this season the canals are generally frozen over, but they are still used as modes of travelling. The people skate along them with surprising rapidity, and it is quite usual to see country girls proceeding to market in this way with baskets of eggs or other articles on their heads.

The Dutch are as remarkable for their enterprise abroad as they are for industry and perseverance at home. Their COMMERCE extends to all parts of the world; and their MANUFACTURES are extensive and valuable. The fine linens of the south, and the earthenware of the north have long been celebrated.

HISTORICAL SKETCH.

In the time of the Romans Holland was inhabited chiefly by the *Batavii* and *Frisii*. After the fall of the Roman Empire it was seized by the Goths and other northern hordes, who divided it into several petty states. It was conquered by Charles Martel in the eighth century, and subsequently formed a part of the dominions of Charlemagne.

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[a] The Rhine, on its entrance into Holland, throws off two branches, the *Waal*, which unites with the Maese, and the *Yssel*, which falls into the Zuyder Zee. The Rhine further divides itself into the *Leck*, &c., and at length finds its way into the sea near Leyden, after having been nearly lost in the sands. The Scheldt receives the Lys at Ghent; and the Maese the Sambre, at Namur. No country in Europe, in proportion to its extent, has so many rivers as Holland.

[b] The dykes are generally 30 feet high, and 70 feet broad at the bottom. They are made of clay, fenced on the land side with wood and stone, and next the sea with mats of rushes or flags, or with sea-weed, which is found to be the best protection against the waves. There are men whose constant business is to keep them in thorough repair. But, notwithstanding every precaution, the sea sometimes breaks in and inundates the neighbourhood. In 1568, some of the islands of Zealand, a great part of the coast of Holland, and almost all Friesland, were laid under water. In this inundation 72 villages were destroyed, and more than 20,000 persons drowned.

From the tenth to the fourteenth century the Netherlands were divided into many petty sovereignties, under the dukes of Brabant, the counts of Holland and Flanders, &c. In 1383, by marriages and otherwise, the whole became subject to the dukes of Burgundy; and subsequently to the house of Austria; and thence it passed into the possession of Spain. In 1579, seven of the provinces threw off the yoke of Spain, and formed themselves into the "Republic of Holland, or the Seven United Provinces," under a supreme magistrate, called the *Stadtholder* or Defender of the State. The seven united provinces were Holland, Friesland, Groningen, Overyssel, Utrecht, Guelderland, and Zealand. The other ten provinces remained subject to Spain till transferred to the German branch of the house of Austria in 1700. See note on Belgium, page 231.

BELGIUM.

Belgium is bounded on the north by Holland; on the west by the German Ocean; on the south by France; and on the east by Rhenish Prussia.

Its length, from east to west, is about 150 miles; and its breadth, from north to south, is about 120 miles. Extent in square miles, 13,214. Population about 4 millions.

Belgium consists of the southern provinces of the late kingdom of the Netherlands, with a portion of the Duchies of Limburg and Luxemburg.

Provinces.	*Chief Towns.*
South Brabant,	Brussels, Louvain, Tirlemont.
Antwerp,	Antwerp, Mechlin or Malines.
West Flanders,	Bruges, Ostend, Courtray, Ypres.
East Flanders,	Ghent, Alost, Oudenarde, Dendermonde.
Hainault,	Mons, Tournay.
Liege,	Liege, Verviers, Spa.
Namur,	Namur, Charleroi.
Belgian Limburg,	Hasselt, St. Tron, Tongres.
Belgian Luxemburg,	Arlon, Bastogne.

Chief Towns.—Brussels, the capital, is one of the most beautiful cities in Europe. It is famous for its manufactures, particularly of lace and carpets. *Antwerp* is the most commercial place in Belgium, and was formerly the first city in Europe for commerce. *Ghent* ranks next to Antwerp in commerce and importance. *Liege* is noted for its university, and extensive manufactures. *Bruges* is an important commercial city. *Ostend* is the principal, and almost the only port of consequence in Belgium. *Mons* and *Namur* are important and strongly fortified towns. *Louvain* is the principal university in Belgium. About seven miles to the south of Brussels, on the edge of the Forest of Soigné, is the village of Waterloo.

Rivers.—The Scheldt or Escaut, with its tributaries, the Lys, Haine, Dender, and Dyle; the Maese or Meuse, with its tributary, the Sambre.

In Belgium the face of the country is generally level, but it occasionally presents a pleasing variety of gentle eminences. It is traversed by canals, but they are less numerous than in Holland.

The CLIMATE is mild, but inclined to moisture. The SOIL is in general fertile, and so highly cultivated, that Belgium has been called the Garden of Europe.

The MANUFACTURES of Belgium are numerous and important. Those of lace, cambric, and woollen, are celebrated. Its COMMERCE was formerly important, but it has greatly diminished.[a]

SWEDEN.

SWEDEN is bounded on the north by Norwegian Lapland; on the west by Norway, the Cattegat, and the Sound; on the south by the Baltic; and on the east by the Baltic, the Gulf of Bothnia, and the River Tornea.

Its length from north to south is about 1,000 miles; and its average breadth, from east to west, is about 200 miles. Area in square miles, about 170,000. Population in 1839, 3,109,772.

Sweden comprises three great divisions, formerly called kingdoms, which are subdivided into 24 läns or governments

Great Divisions.	*Chief Towns.*
Sweden Proper, .	STOCKHOLM, Upsal, Gefle.
Gothland, . .	Gottenburg, Carlscrona, Norrköping, Calmar.
Norrland, including West Bothnia, and Swedish Lapland,	Tornea, Umea, Hernosand.

CHIEF TOWNS.—*Stockholm*,[b] the capital, is built on several small islands and peninsulas, at the junction of Lake Mœlar with the Baltic. It has a safe and capacious harbour, and extensive trade. Its arsenal is famous. *Gottenburg*, on the Cattegat, ranks next to Stockholm for commerce and population. *Upsal* is celebrated for its university.[c] *Carlscrona* has considerable trade, and is the principal station of the Swedish navy. *Fahlun* is noted for its copper mines. *Norrköping* and *Gefle* are places of considerable trade. *Calmar* is famous as the place in which the treaty for the union of the three kingdoms was concluded in the year 1397.

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[a] After the time of Charlemagne, Belgium, or Flanders, as it was then called, became subject to the counts of Flanders; next to the dukes of Burgundy; and subsequently to the house of Austria. Napoleon annexed it to France in 1795, but it was in 1814 taken from France, and joined with Holland, to form the kingdom of the Netherlands. This kingdom was broken up by the Revolution in 1830 into the present kingdoms of Belgium and Holland.

[b] *Stockholm*.—The name given to this city evidently refers to its position, and the mode in which it must have been built. *Holm* signifies an island, formed by a river, and *stock* is another form of the word *stake*. In such sites, the foundations of buildings are supported by *stakes* or timbers driven into the earth. See the observation on *Amsterdam*, page 228.

[c] It is from the observatory of *Upsal* that the Swedish geographers reckon longitude.

The soil of Sweden is in general very unproductive; and scarcely one-twentieth part of the country is capable of cultivation. The chief wealth is derived from its *mines*[a] and *forests*. Its *fisheries* are also extensive and valuable.

HISTORICAL SKETCH.

Sweden was originally occupied by the *Fins*, and afterwards by the *Goths*, &c. Hence the names *Finmark*,[b] *Finland*, *Gothland*, *Gottenburg*,[c] &c. In 1397, it was, with Norway, united to Denmark under the celebrated Danish Queen Margaret. It remained subject to Denmark till 1523, when it recovered its independence under the famous Gustavus Vasa. Among the succeeding monarchs, Gustavus Adolphus, and Charles XII., were the most celebrated. In 1810, Bernadotte, one of Napoleon's generals, was elected king; and in 1814, Norway was wrested from Denmark by the Allied Sovereigns, and added to Sweden.

NORWAY.

Norway is bounded on the north by the Northern Ocean; on the west by the Northern and Atlantic Oceans; on the south by the Skager Rack; and on the east by Sweden.

Its length from the Naze to Nordkün is upwards of 1,000 miles; and its breadth, from east to west, varies from 50 to 250 miles. Area in square miles nearly 122,000. Population about 1,200,000.

Norway may be divided into Norway Proper or Southern Norway, and Norrland or Northern Norway. *Norway Proper* contains the four provinces of Aggerhuus or Christiania, Christiansand, Bergen, and Drontheim. *Norrland* comprises that part of Norway north of Drontheim, with Finmark or Norwegian Lapland.

Provinces.	*Chief Towns.*
Aggerhuus or Christiania,	Christiania, Frederickshall, Frederickstadt, Kongsberg, Drammen.
Christiansand, . . .	Christiansand, Stavanger.
Bergen, ...	Bergen.
Drontheim, . . .	Drontheim, Rœraas.
Norrland, Finmark or Norwegian Lapland, .	Tromsoe, Hammerfest, Wardhuus.

Chief Towns.—*Christiania*, the capital or seat of government, is the best built town in the kingdom, and has extensive commerce. *Bergen* is equal in population, and more commercial, and is usually regarded as the capital. *Drontheim* or *Tronyem*, the ancient capital, and residence of the Norwegian kings, is a place of considerable commerce. The other towns of Norway are very small; as *Kongsberg*, noted for its silver mines; *Frederickshall*, at the siege of which Charles XII. was killed, &c.

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[a] The annual produce of the mines of Sweden is about 100,000 tons of iron, 1,200 tons of copper, and 1,000 lbs. of silver. The best iron is procured from the mines of Dannemora, 30 miles north from Upsal; and the most celebrated copper mines are at Fahlun, in Dalecarlia.

[b] *Finmark*.—That is, the boundary *(march)* or country of the *Fins*. Compare *Denmark* (of the *Danes*.)

[c] *Gottenburg*.—That is, the stronghold or town *(burg)* of the *Goths*. The present king of Sweden, at his recent accession to the throne, was proclaimed "King of Sweden and Norway, and of the *Goths* and *Vandals*."

Islands.—The Loffoden Isles and Mageroe on the north; Hitteren and Vigten Isles on the west, &c.

Bays.—West Fiord and Drontheim Bay on the west; and Christiania Bay on the south.

Mountains.—The Dovrefield and Kolen Mountains, between Norway and Sweden; and the Langefield Mountains, between Aggerhuus and Bergen.

Rivers.—The Glommen, Drammen, and Louven, into the Skager Rack; and the Tana and Alten, into the Northern Ocean.

Lakes.—Miosen, Rands, Tyri, Foemund, &c.

Norway is a rugged and mountainous country, possessing, however, numerous valleys, and large tracts, of great fertility, particularly in the south.[a] A rugged chain of mountains separates it from Sweden; and the coasts are indented with *fiords* or inlets of the sea, and covered with rocky islands. The scenery is more diversified than Sweden with mountains, forests, valleys, lakes, rivers, precipices, and cataracts. The climate resembles that of Sweden; but it is neither so cold in winter, nor so warm in summer.

The chief wealth of Norway is derived from its mines,[b] forests, and fisheries. Its rocky coasts and islands are inhabited by numerous birds which supply the eider-down of commerce.

Among the Loffoden Isles is the celebrated and dangerous whirlpool called the *Malstrom*.

The Norwegians are a simple, but a brave, frank, and hospitable people. Education is in a backward state, but efforts are making to promote it. Most of the peasantry manufacture their own clothing, tools, and furniture.

HISTORICAL SKETCH.

Norway was originally peopled by the *Fins* and *Laps*, who in after times were driven to the northern extremities by the *Goths*. In 875, Harfager or the *Fair-haired*, united the petty states of Norway into one monarchy, and from that period (except during the time it was subject to Canute the Great, in 1028), it was governed by its own kings till the year 1397, when it was annexed to Denmark by the famous Union of Calmar. In 1814 it was annexed to Sweden by the Congress of Vienna; but it is still a distinct kingdom, and governed by its own laws.

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[a] Scarce one hundredth part of the country is under, or is, perhaps, capable of cultivation.

[b] The iron-mines of Arendal, the copper-mines of Rœraas, and the silver-mines of Kongsberg, are the most productive

LAPLAND.

LAPLAND occupies the northern extremity of Europe. Though partitioned among Norway, Sweden, and Russia, it is considered as one country, on account of the peculiar character and habits of the people. The population of the whole of Lapland amounts to about 60,000; but the *Laplanders* themselves do not amount to more than 9,000. The other occupants are Russians, Swedes, and Norwegians.

The chief towns are *Tornea* in Swedish, and *Kola* in Russian Lapland. But the Laplanders generally live in huts, or lead a wandering and barbarous life. They profess Christianity, but they are very ignorant of the Scriptures, and retain many Pagan superstitions. They are dwarfish in stature, seldom exceeding four feet in height.

The chief wealth of the Laplanders is the *rein-deer*. In the winter they carry on some traffic with the Swedes at Tornea, and other places on the Gulf of Bothnia. They exchange, at this season, skins, furs, dried fish, venison, and gloves, for flannel, cloth, hemp, copper, iron, and various utensils, but particularly for spirituous liquors, meal, salt, and tobacco.

GREECE.

GREECE is bounded on the north by Turkey; on the west and south by the Mediterranean; and on the east by the Archipelago.

Its length, from Cape Matapan to its extreme northern boundary, is nearly 180 miles; and its breadth, from Cape Clarenza to the coast near Marathon, is about 150 miles. Area in square miles about 17,000. Population nearly one million.

Greece comprises three great divisions, namely, Hellas or Continental Greece, called also Livadia; the peninsula of the Morea: and Eubœa or Negropont, and the other islands.

In 1833 the whole country was divided into ten *nomoi* or *nomarchies*, five of which are in the Morea, three in Hellas, and two are made up of the islands.

Nomarchies.	*Chief Towns.*
HELLAS:	
Attica and Bœotia,	ATHENS, Thebes, Livadia.
Locris and Phocis,	Zeitoun, Salona.
Acarnania and Etolia,	Missolonghi, Lepanto.
MOREA:	
Argolis and Corinth,	Nauplia, Hydra, Argos, Corinth.
Achaia and Ellis,	Patras.
Arcadia,	Tripolitza.
Messenia,	Modon, Navarino.
Laconia,	Mistra.
ISLANDS:	
Eubœa and N. Sporades,	Chalcis or Egripo.
Cyclades,	Hermopolis.

CHIEF TOWNS.—*Athens,* the capital, is a mean town, but interesting from its ancient name and splendour. It still contains many relics of its former magnificence. *Nauplia* (or Napoli di Romania), the late capital, is the best built town in Greece, with a fine harbour and a fortress. *Tripolitza* was the residence of the Turkish Pacha, and the capital of the Morea. The Turks razed it to the ground, but it is again an important town. *Hydra,* on the island of the same name, is the largest and most populous town in Greece. The *Hydriot* sailors are noted for their skill and intrepidity. *Patras* is noted for its commercial activity. *Missolonghi* is memorable as the place where Lord Byron died. *Mistra* is near the site of the ancient Sparta.

ISLANDS.—Negropont, Skyro, Ispara, Egina, Salamis, Poros, Hydra, Spezzia; the CYCLADES, the principal of which are Andro, Tino, Micono, Zea, Syra, Naxia, Paros, Antiparos, Milo, Santorini, Nio.

GULFS.—Patras, Lepanto, Egina, Nauplia, &c.

CAPES.—Colonna, Matapan, Maleo or St. Angelo, &c.

MOUNTAINS.—Parnassus and Helicon, in Livadia; Taygetus or the Mountains of Maina, in the Morea.

The SURFACE of the country is beautifully diversified with mountains, valleys, and plains. The SOIL is, for the most part, very fertile; and the CLIMATE is, in general, mild, delightful, and healthy, except in the low and marshy tracts round the shores and lakes.

Greece is capable of great agricultural improvement; and its numerous bays and harbours render it admirably adapted for commerce. The Greeks are a lively and ingenious people, but they are accused of being deceitful and treacherous. These vices were naturally engendered by the tyranny and oppression of the Turks. But now that they are no longer slaves, it is to be hoped that they will prove themselves worthy of freedom, and of their ancient name. The heroism displayed by many of them in their late struggles with the Turks was worthy of the best days of Greece.

The monarchy established in Greece is under the protection of England, France, and Russia.

The national religion is the Greek Church, so called from having been established by the Greek emperors, the successors of Constantine the Great.

IONIAN ISLANDS.

THE Ionian Islands, on the west coast of Greece, form a republic under the protection of the British crown.

These islands are Corfu, Paxo, Santa Maura, Ithaca, Cephalonia, Zante, and Cerigo; and the capital city is CORFU.

The extent of this little republic in square miles is about 1,000; and the population in 1837 was 208,100.

The inhabitants are a mixture of Greeks and Italians. They are ingenious and active; and export considerable quantities of wine, oil, oranges, lemons, and dried fruit.

The government resembles that of England, with a commissioner at its head deputed by the crown.

TURKEY IN EUROPE.

TURKEY in Europe is bounded on the north by Austria and Russia; on the west by Dalmatia and the Adriatic; on the south by Greece and the Archipelago; and on the east by the Dardanelles, the Sea of Marmora, the Straits of Constantinople, and the Black Sea.

Its length from Constantinople to the Adriatic is nearly 500 miles; and its breadth, from the Danube at Belgrade, to the northern frontier, is about 400 miles. Area in square miles, about 200,000. Population about 10 millions.

Provinces.	*Chief Towns.*
Bulgaria,	Sophia, Schoumla, Varna.
Bosnia and Croatia,	Bosna-Serai, Trawnik, Mostar.
Albania,	Janina, Durazzo, Scutari.
Macedonia,	Salonica, Seres.
Thessaly,	Larissa, Tricala, Pharsalia.
Roumelia,	CONSTANTINOPLE, Adrianople, Philippopolis, Gallipoli.
Tributary Provinces.	
Moldavia,	Jassy, Galatz.
Wallachia,	Bucharest, Tergovist.
Servia,	Belgrade, Semendria, Nissa.

CHIEF TOWNS.—*Constantinople*, the capital of the Mahommedan world, was founded by Constantine the Great, in the year 330; from which period till it was taken by the Turks in 1453, it was the capital of the Roman empire in the East. It is beautifully situated, and its harbour is one of the finest in the world. It contains many splendid and graceful-looking buildings, which give it a magnificent appearance from without; but its interior falls far short of its exterior beauty. The houses are in general low and badly built, and the streets, with few exceptions, are narrow and dirty. *Adrianople* is the second city in importance and population, and was formerly the capital of the Turkish empire in Europe. It is called after the Emperor *Adrian*. *Sophia* or *Triaditza*, ranks next in importance. It is badly situated, and has a mean appearance. *Belgrade* is strongly fortified, and is famous as the scene of desperate battles and obstinate sieges between the Austrians and Turks. *Bucharest*, the capital of Wallachia, is a flourishing town. *Salonica*, the ancient *Thessalonica*, is the next to Constantinople in commercial importance. *Schoumla* is a strongly-fortified and important town. *Varna*, 47 miles east from Schoumla, is also a strongly fortified town. It was taken by the Russians in 1828.

ISLANDS.—In the Mediterranean, Candia, the ancient *Crete*; in the Archipelago, Rhodes, Scio, Lesbos or Mytelene, Lemnos, Patmos, &c.; in the Levant, Cyprus.

SEAS AND STRAITS.—The Archipelago, the Sea of Marmora, the Dardanelles, the Straits of Constantinople.

GULFS.—The Gulf of Arta, Volo Salonica, &c

MOUNTAINS.—The Hæmus or Balkan, Rhodope, Athos, Olympus, Ossa, Pelion, Pindus.

RIVERS.—The Danube, Save, Pruth, Maritza, &c.

The SURFACE of the country, generally speaking, is mountainous, but diversified with rich and beautiful valleys, and extensive and fertile plains. The CLIMATE is, in general, delightful, but the country is sometimes visited by the plague. The SOIL is very rich, but agriculture, like every other art and science, is despised and neglected by the Turks.

Manufactures and commerce are in a neglected state, and chiefly in the hands of foreigners.

The Turks have the character of being haughty, revengeful, and cruel, vices to which their blind and bigoted attachment to their own religion, and their hatred and intolerance of others, naturally lead. They are found, however, to be hospitable in their intercourse with strangers, and fair, and honest, in their dealings. They are grave in their aspect and deportment, and exceedingly indolent in their habits.

The Turks are almost wholly uneducated. Popular education consists chiefly in being able to read the Koran; and the knowledge of their learned men amounts to little more than to an acquaintance with its dogmas and ordinances. In fact, the Koran may be said to embrace their religion, laws, and literature. The arts and sciences they regard with contempt and aversion, as the attainments of what they call the infidel world; and painting and statuary are entirely prohibited as profane imitations of the works of the Creator.

The government of Turkey is a despotism of the worst kind,[a] but its rigours have been mitigated of late years through the influence of its European connexions. Its power, which once threatened to enslave all Europe, has long been on the decline, and, in fact, is only kept from dissolution by the mutual jealousies of the Great European Powers. Its dominion in Africa may be said to have passed away; and in Europe it has lost Greece, and its power over the provinces of Servia, Moldavia, and Wallachia, is little more than nominal. In Asia, too, its power is greatly circumscribed. But for the armed interference of the Christian Powers of Europe, particularly England, the whole of Syria would lately have been wrested from the Sublime Porte.

HISTORICAL SKETCH.

The Turks are of Tartar origin. About the year 800, they took possession of a part of Armenia, which was called from that circumstance *Turkomania*. They afterwards extended their conquests over Syria, Asia Minor, Egypt, and Europe. In 1360, they took Adrianople, and in 1453, Constantinople, which put an end to the Roman empire in the East. The conquest of the Crimea and Morea soon followed; and in 1440, they captured Otranto in Italy. Rhodes was taken in 1522 by Soliman the Magnificent, the terror of Europe; and in 1529, Buda. In the same year Vienna was besieged, but it was saved by the advance of Charles V. In 1683 they again attacked Vienna with an army of 200,000 men, but were repulsed with great slaughter.

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[a] Chateaubriand describes the government of Turkey as a despotism tempered by, regicide.

ASIA.

Asia is the largest, the most populous, and in many respects the most interesting of the great divisions of the globe. It was here that the human race was first planted; and here occurred almost all the interesting events recorded in the Bible. Here, too, the great empires of antiquity rose and fell; and from Asia the elements of society, civilization, and learning, were spread over the other divisions of the earth.

Asia is bounded on the north by the Arctic Ocean, on the east by the Pacific Ocean, on the south by the Indian Ocean, and on the west by Europe, the Mediterranean and Red Sea.[a]

Its length, from the western extremity of Asia Minor (Cape Baba) to the eastern coast of Corea, is about 6,000 miles; and its breadth, from the southern extremity of Malacca to Cape Severo or Taimura in Siberia, is about 5,300 miles.

Its AREA may be *estimated* at about 16,000,000 of square miles, and its POPULATION at about 400,000,000.

GENERAL DIVISIONS.[b]

Siberia, or Asiatic Russia, extends over the entire *north* of Asia.

The *south* of Asia, like the south of Europe, consists of three great projections or peninsulas, which comprise Arabia, India within the Ganges, or Hindostan, and India beyond the Ganges, or Chin-India.

In the *middle* regions of Asia, to the *west*, are the Turkish dominions, including Asia Minor, Armenia, Syria, and the Holy Land; and to the *south-west*, Arabia, Persia, and Afghanistan. In the *centre*, are Independent and Chinese Tartary; and to the *east*, the vast and populous empire of China.

Near the *eastern* coast is the *insular* empire of Japan, corresponding to the British Islands on the west coast of Europe.

China.—The *area* of China and its dependencies may be estimated at about equal to a *third* of the whole continent· and the *population* at about 170,000,000.

Hindostan.—This vast and important country is, with few exceptions, either subject to, or under the influence of British dominion.

The independent states are Lahore, Nepaul, and Sinde.

The other European settlements in Hindostan are of little importance, namely, one of the Portuguese at Goa; two of the

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[a] It extends from 1° 20′ to 78° north latitude, and from 26° east to 170° west longitude.

[b] Refer to page 125 for a description of the great natural divisions of Asia.

French at Chandernagore and Pondicherry; and two of the Danes at Tranquebar and Serampore.[a]

India beyond the Ganges is divided into Assam, Birmah, and Malacca, on the west; Siam in the middle; and on the east the empire of Annam or Tonquin, which occupies the whole of the eastern part, including Tonquin, Cochin-China, Siampa, and Cambodia on the coast, and Laos in the interior. The British have considerable influence in Assam, Birmah, and Malacca.

ESTIMATE OF THE EXTENT, POPULATION, AND CAPITALS OF THE PRINCIPAL COUNTRIES IN ASIA.

States.	English square miles.	Population.	Pop. to square mile.	Capitals.
Afghanistan,	400,000	7,000,000	17·5	Cabul.
Annam, Empire of,	120,000	10,000,000	83	Hué.
Arabia,	1,000,000	10,000,000	10	Mecca.
Birman Empire,	250,000	3,500,000	14	Ava.
Chinese Empire,	5,350,000	170,000,000	32	Pekin.
Hindostan,	1,280,000	134,000,000	104·7	Calcutta.
Japan Empire,	260,000	25,000,000	96	Jeddo.
Persia,	450,000	9,000,000	20	Teheran.
Russia in Asia,	5,500,000	6,000,000	1·1	Tobolsk.
Siam,	200,000	4,000,000	20	Bankok.
Tartary (Independent),	400,000	5,000,000	12·5	Bokhara.
Turkey in Asia,	450,000	12,000,000	27	Smyrna.

PRINCIPAL COUNTRIES IN ASIA.

Countries.	*Chief Towns.*
China,	Pekin, Nankin, Canton, Macao,[b] Amoy, Foo-choo-foo, Ningpo, Shanghae.
Hindostan,	Calcutta, Madras, Bombay, Delhi, Agra, Surat, Benares, Lucknow, Lahore.
India beyond the Ganges,	Ava, Rangoon, Bankok, Hué.
Persia,	Teheran, Ispahan, Shiraz.
Afghanistan or Cabul, and	Cabul, Candahar, Herat, Peshawer.
Beloochistan,	Kelat, Kidje.
Arabia,	Mecca, Medina, Sana, Muscat, Mocha, Aden,[c] Jidda.
Turkey in Asia, including	
Asia Minor,	Smyrna, Burza, Trebizond.
Armenia,	Erzeroum, Erivan,[d] Van.

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[a] The extent of the whole of India possessed by the Portuguese, French, and Danes, has been estimated at 7,430 square miles, and the population at 745,000.

[b] *Macao* belongs to the Portuguese. It is on an island in the bay of Canton.

[c] *Aden* belongs to Britain. It is near the entrance of the Red Sea.

[d] *Erivan*, and the province of Armenia in which it is situated, now belongs to Russia.

Countries.	*Chief Towns.*
Diarbekir and Kurdistan,	Diarbekir, Mosul, Betlis.
Irak-Arabi, . .	Bagdad, Bassora, Hillah.
Syria, . . .	Aleppo, Tripoli, Damascus, Acre, Beyrout, Antioch, Sidon or Saida, Tyre.
Palestine, . . .	Jerusalem, Jaffa, Gaza.
Russian Asia, . . .	Astrachan, Tobolsk, Irkutsk, Tiflis.[a]
Independent Tartary, .	Bochara, Kokan, Samarcand, Khiva, Balkh.
Chinese Tartary, . .	Cashgar, Yarkand.
Thibet, ...	Lassa, Ladak.
Japan Isles, . . .	Jeddo, Miaco, Matsmai.
Ceylon, ...	Candy, Colombo, Trincomalee.

SEAS, GULFS, BAYS, AND STRAITS.

Seas.—The principal seas of Asia are, the Red Sea, the Arabian Sea, the Chinese Sea, the Yellow Sea, the Sea of Japan, the Sea of Okhotsk, the Sea of Kamtschatka; the Bay of Bengal; the Persian Gulf, the Gulf of Siam, the Gulf of Tonquin; the Straits of Babelmandeb; the Straits of Ormuz, Behring's Straits; and the Straits of Malacca, Macassar, and Sunda.

ISLANDS, PENINSULAS, CAPES.

The principal islands belonging to Asia are, the Japan islands, the Philippine Islands, Ceylon, Borneo, Sumatra, Java, Celebes, the Moluccas or Spice Islands; the Chinese Islands, Hainan and Formosa; Saghalien, Loo Choo, the Laccadive and Maldive Islands, the Andaman and Nicobar Islands, the Kurile Isles, the Aleutian or Fox Islands.

Peninsulas.—Hindostan, Malacca or Malaya, Cambodia, Corea, and Kamtschatka.

Capes.—In the north of Asia, Cape Taimura or Severo, North Cape, East Cape, Cape Lopatka, in Kamtschatka; Cape Romania, south of the Eastern, and Cape Comorin, south of the Western Peninsula of India.

MOUNTAINS, RIVERS, LAKES.

Mountains.—The principal mountains are, the Himalehs, the Altai, the Caucasus, the East and West Ghauts; the Taurus, the Lebanon, and the Ural ranges.

Rivers.—The Kiang-ku or Yang-tse-kiang, the Hoang-ho, the Lena, the Yenessei, the Oby, the Amour or Saghalien, the Ganges, the Brahmaputra, the Irrawaddy, the Indus, the Euphrates, the Tigris, the Gihon or Oxus, the Sihon or Jaxartes, and the Maykaung or Cambodia.

Lakes.—The Caspian Sea, the Sea of Aral, the Dead Sea, and Lake Baikal.

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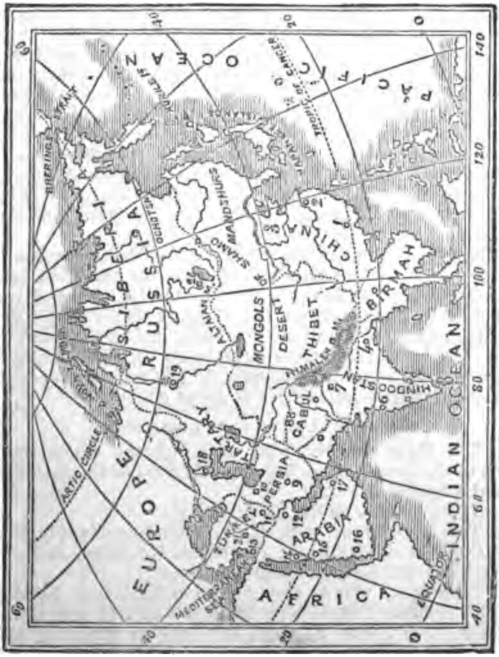
[a] *Tiflis* is the capital of Georgia.

ASIA.



References to the Map of Asia.

Aleppo,	**21**	**Canton,**	**1**	**Medina,**	**14**
Astrachan	**18**	**Delhi,**	**7**	**Muscat,**	**17**
Bagdad,	**11**	**Irkutsk,**	**20**	**Nankin,**	**2**
Bassora,	**12**	**Ispahan,**	**9**	**Pekin,**	**3**
Bombay,	**6**	**Jerusalem,**	**13**	**Sana,**	**16**
Cabul,	**8**	**Madras,**	**5**	**Teheran,**	**10**
Calcutta,	**4**	**Mecca,**	**15**	**Tobolsk,**	**19**

AFRICA.

AFRICA is remarkable for its vast deserts of burning sand, the ignorance and barbarism of its inhabitants, and the number and ferocity of its animals. Though some countries of Africa, particularly Egypt and Carthage, were early distinguished for civilization and commerce, yet it is at the present day the least known of all the great divisions of the globe; and it is greatly to be feared that even the noble efforts[a] now making under the sanction of the British parliament to introduce civilization and Christianity into the heart of this great continent, will, like all those that preceded them, be defeated *by the nature of the climate,* if not by the barbarism of the inhabitants.

Africa is bounded on the north by the Mediterranean Sea; on the south by the Southern Ocean; on the west by the Atlantic Ocean; and on the east by the Red Sea and Indian Ocean.[b] Its length from the Cape of Good Hope to the Mediterranean is about 5,000 miles; and its breadth from Cape Verde to Cape Guardafui is about 4,700 miles. Its AREA may be *estimated* at about 10,000,000 of square miles English, and its POPULATION at about 80,000,000.[c]

GENERAL DIVISIONS OF AFRICA.

1. The BARBARY STATES, including the whole country north of the desert of the Sahara, and west of the 25th degree of east longitude.

2. The SAHARA, or the Great Desert.

3. The REGION OF THE NILE, including Egypt, Nubia, with Dongola and Sennaar; Abyssinia, Kordofan, and all the country drained by its affluents.

4. NIGRITIA, which may be subdivided into *Soudan* or North Nigritia, Central Nigritia, and Southern Nigritia.

SOUDAN, or North Nigritia, lies between the Kong Mountains and the Sahara; and is watered by the Senegal, Gambia, Niger, and the rivers flowing into Lake Tchad.

CENTRAL Nigritia lies between the Kong Mountains and the northern shore of the Gulf of Guinea to the Bight of Biafra.

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[a] This alludes to the recent expedition to Africa, which, to the great regret of every benevolent mind, has been defeated, as was here anticipated, by the nature of the climate.

[b] It extends from 34° 52′ south, to 37° 21′ north latitude, and from 17° 33′ west, to 51° 30′ east longitude.

[c] The population of Africa may be divided into seven distinct races, namely, the Numidians or Moors, the Egyptians, the Nubians, the Abyssinians, the Caffres, the Negroes and the Hottentots.

SOUTHERN Nigritia includes the countries from the Bight of Biafra along the coast to Cape Negro, and inwards to the sources of the rivers flowing through it to the coast.

5. SOUTHERN Africa, or the regions south of Cape Negro, on the west, and of the Zambese river on the east.

6. EASTERN Africa, or the regions north of the Zambese river, round by the sea-coast to the confines of Abyssinia and the Gebel-el-Komri, or Mountains of the Moon.

7. The ISLANDS of Africa are, Madagascar, Bourbon, Mauritius or Isle of France, the Comoro Isles and Socotra, on the east coast; and the Madeira, Canary, and Cape Verde Islands, St. Helena, St. Thomas, Ascension, Goree, and Fernando Po on the west coast.

PRINCIPAL COUNTRIES IN AFRICA.

Countries.	*Chief Towns.*
Egypt,	Cairo, Alexandria, Suez.
Barbary, which includes	
Morocco and Fez,	Morocco, Mogadore; Fez, Mequinez.
Algiers,	Algiers, Constantina.
Tunis,	Tunis, Susa, Cabes.
Tripoli,	Tripoli.
Fezzan,	Mourzouk.
Barca,	Derna.
Nubia,	Sennaar, Dongola.
Abyssinia,	Gondar, Axum.
Upper Guinea,	Freetown, Benin.
Lower Guinea,	Loango, St. Salvador.
Nigritia,	Timbuctoo, Bornou.
Cape Colony,	Cape Town.

SEAS, GULFS, BAYS, AND STRAITS.

SEAS.—The principal seas of Africa are, the Mediterranean and the Red Sea; the Gulfs of Guinea, Sidra, and Cabes; Saldanha and Table Bays; the Channel of Mozambique; the Straits of Gibraltar and Babelmandeb.

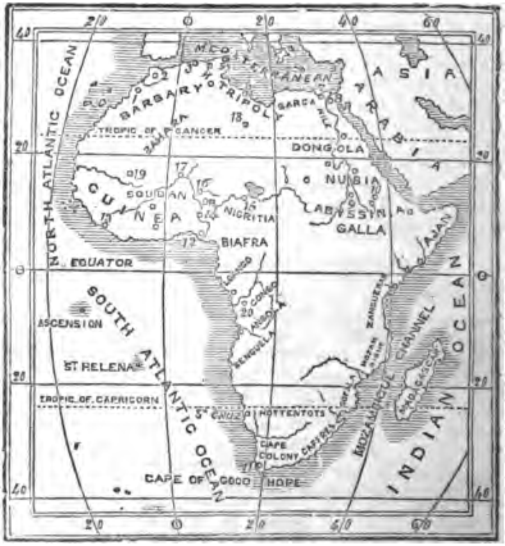
CAPES.—The principal capes are, the Cape of Good Hope, Cape Bon, Cape Verde, Cape Guardafui, Capes Spartel. Bojador, Blanco, Palmas, Three Points, Formosa, and Negro.

MOUNTAINS.—The principal mountains are, Mount Atlas, the Mountains of the Moon, the Kong Mountains, the Mountains of Lupata, the Mountains of Abyssinia, and Sierra Leone.

RIVERS.—The principal rivers are, the Nile, the Niger or Quorra, the Senegal, the Gambia, the Zaire or Congo, the Coanza, the Orange River or Gareep, and the Zambese.

LAKES.—The principal lakes are, Tchad, Debo or Dibbie, Dembea, and Maravi.

AFRICA.



References to the Map of Africa.

Alexandria,	7	Cape Town,	11	St. Salvador,	20
Algiers,	3	Constantina,	4	Sennaar,	9
Benin,	12	Fez,	2	Sierra Leone,	13
Benoum,	19	Gondar,	10	Suez (under),	8
Bornou,	15	Morocco,	1	Timbuctoo,	17
Boussa,	14	Mourzouk,	18	Tripoli,	6
Cairo,	8	Sackatoo,	16	Tunis,	5

AMERICA.

America, or the New World, was discovered in the year 1492 by Christopher Columbus, a native of Genoa. It is distinguished from all the other great divisions of the globe by the size and grandeur of its mountains, lakes, and rivers.

America is bounded on the north by the Arctic Ocean; on the south by the Antarctic Ocean; on the east by the Atlantic; and on the west by the Pacific Ocean. It is divided by the

Gulf of Mexico and the Caribbean Sea into two vast peninsulas—one of which is called North, and the other South America. North and South America are united by the Isthmus of Darien and Panama, which in one part is only twenty-eight miles across. The length of the whole continent from north to south is upwards of 9,000 miles.[a] The breadth of North America, where broadest, is about 3,500 miles; and of South America about 3,200 miles.

The AREA of America may be estimated at about fifteen millions of square miles; and the POPULATION at about fifty-five millions.[b]

GENERAL DIVISIONS OF NORTH AMERICA.

The *northern* part of North America, from the great lakes to the Arctic Ocean, is called British America, except a portion of the north-western extremity, which belongs to Russia.

The *middle* regions, from the Atlantic to the Pacific, belong to the United States.

The *southern* parts, and the Isthmus, form the republics oı Mexico and Guatimala.

THE BRITISH POSSESSIONS.

States.	*Chief Towns.*
Labrador, or New Britain,	Nain Fort.
Hudson's Bay, . .	York Fort.
Upper Canada, . .	Toronto, Kingston.
Lower Canada, . .	Quebec, Montreal.
New Brunswick, . .	Fredericton, St. John's.
Nova Scotia, . . .	Halifax, Pictou.
Newfoundland, . .	St. John's.
Cape Breton, . . .	Louisburg, Sydney.
Prince Edward's Island, .	Charlotte Town.

THE UNITED STATES.

NEW ENGLAND, OR NORTHERN STATES.

Maine, ...	Augusta, Portland, Bangor.
Massachusetts, . .	Boston, Salem, Lowell.
New Hampshire, . .	Concord, Portsmouth, Dover.
Vermont, . . .	Montpelier, Burlington.
Rhode Island, . .	Providence, Newport.
Connecticut, . . .	Hartford, Newhaven.

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[a] From about the 72nd degree of north, to about the 56th degree of south latitude.

[b] Of the whole population of America, it may be estimated that about 10,000,000 are Indians; 8,000,000, Negroes; 7,000,000 of mixed race; and 30,000,000 Europeans or descendants of Europeans.

MIDDLE STATES.

States.	*Chief Towns.*
New York,	New York, Albany.
Pennsylvania,	Philadelphia, Pittsburg.
New Jersey,	Newark, Trenton.
Delaware,	Wilmington, Dover.
Maryland,	Baltimore, Annapolis.
Virginia,	Richmond, Norfolk.
District of Columbia,	Washington, Georgetown.

SOUTHERN STATES.

North Carolina,	Raleigh, Newbern.
South Carolina,	Charlestown, Columbia.
Georgia,	Savannah, Augusta.
Alabama,	Mobile, Tuscaloosa.
Florida,	Tallahasee, St. Augustine.

WESTERN STATES.

Ohio,	Cincinnati, Columbus.
Kentucky,	Lexington, Louisville.
Tenessee,	Nashville, Knoxville.
Michigan,	Detroit.
Indiana,	Indianopolis, Vincennes.
Illinois,	Chicago, Vandalia.
Missouri,	St. Louis, Jefferson.
Arkansas,	Little Rock.
Mississippi,	Natchez, Jackson.
Louisiana,	New Orleans.
Texas,	Galveston, Austin, Houston.
Oregon, or Western Territory,	Astoria.

LATE SPANISH POSSESSIONS, NOW REPUBLICS.

Mexico,	Mexico, Vera Cruz, Acapulco.
Guatimala,	St. Salvador, Guatimala, Leon.

BAYS, GULFS, AND STRAITS.

The principal bays, gulfs, and straits of North America are, Baffin's Bay, Hudson's Bay, Bay of Fundy, Chesapeak Bay, Bay of Honduras, Bay of Campeachy, Delaware Bay, Gulf of Mexico, Gulf of St. Lawrence, Gulf of California, Davis' Straits, Hudson's Straits, Behring's Straits, Barrow's Straits, Straits of Belleisle; and Nootka Sound.

ISLANDS.

The principal islands are, the West Indies, the Bahamas, the Bermudas, Newfoundland, Cape Breton, Prince Edward's, Anticosti, Long Island, Rhode Island, Vancouver's Island, Queen Charlotte's Island, Greenland, North Georgian, Melville, and Bathurst Islands.

PENINSULAS.—Nova Scotia, Florida, Yucatan, California, Alaska.

Capes.—Capes Farewell, Chidley, Hatteras, Sable, St. Antonio, Lucas.

Mountains.—The Rocky Mountains, the Apalachian or Alleghany Mountains, the Mountains of Mexico, Mount St. Elias, Mount Fairweather, &c.

Rivers.—The Mississippi and Missouri, the St. Lawrence, the Arkansas, the Rio Bravo or del Norte, the Mackenzie River, the Ohio, the Red River, the Tennessee, the Columbia, the Coppermine River, &c.

Lakes.—Superior, Michigan, Huron, Erie, and Ontario; Great Bear Lake, Great Slave Lake, Lake Athabasca, Winnipeg, and Nicaragua.

GENERAL DIVISIONS OF SOUTH AMERICA.

The *northern* parts of South America comprise Colombia, which contains the republics of New Granada, Ecuador or Equator, and Venezuela; and Guiana, in which the English, French, Dutch, Spanish, and Portuguese, have settlements.

The *eastern* part forms the vast Portuguese empire of Brazil; and on the *western* coast are Chili, Peru, and Bolivia or Upper Peru.

The *inland* portion between Brazil, Bolivia, and Chili, comprises La Plata, or the Argentine Republic, Paraguay, and Banda Oriental or Uruguay.

The *southern* extremity, from the Pampas of La Plata to Cape Horn, is called Patagonia.

Between the two continents are the *West Indies*, or the Columbian Archipelago.

States.	*Chief Towns.*
Colombia, which includes	
New Granada, . . .	Santa Fe de Bogota, Carthagena.
Venezuela, . . .	Caraccas, Cumana, Truxillo.
Ecuador or Equator, .	Quito, Guayaquil, Cuença.
Brit. Guiana, or Demerara,	Georgetown.
Essequibo, and Berbice,	New Amsterdam.
Surinam or Dutch Guiana,	Paramaribo.
French Guiana, . . .	Cayenne.
Brazil, ...	Rio Janeiro, Bahia or St. Salvador.
Peru, ...	Lima, Cuzco, Callao, Truxillo.
Bolivia or Upper Peru, .	Chuquisaca, Potosi, La Paz, Santa Cruz.
Chili, ...	St. Jago, Valparaiso.
La Plata, ...	Buenos Ayres, Cordova, Santa Fe.
Paraguay, ...	Assumption, New Coimbra.
Banda Oriental or Uruguay,	Monte Video.

ISLANDS.

The principal islands of South America are, the Falkland Islands. Terra del Fuego, South Georgia, Sandwich Land, New South Shetland Islands, Juan Fernandez. Galapagos, &c.

Capes.—Cape St. Roque, Cape Horn, Cape Blanco, Cape Vela, &c.

SEAS, GULFS, BAYS, STRAITS.

The principal seas, gulfs, bays, and straits are, the Caribbean Sea, the Gulfs of Darien, Maracaybo, Guayaquil, All Saints' Bay, Bay of Panama, the Straits of Magellan, and Straits of Le Maire.

Mountains.—The Andes or Cordilleras, and their subordinate branches; as the Chain of Venezuela, the Chain ot Chiquitos, the Mountains of Brazil and Paraguay.

Rivers.—The Amazon, the La Plata, the Orinoco, the Magdalena, the Madeira, the Francisco, &c.

Lakes.—Titicaca in Bolivia, and Maracaybo in Colombia.

ESTIMATE OF THE EXTENT AND POPULATION, WITH THE CAPITALS, OF THE PRINCIPAL COUNTRIES OF AMERICA.

States.	English square miles.	Population.	Capitals.
British America,[*] - -	3,000,000	3,250.000	Quebec.
Central America, - -	200,000	2,000,000	St. Salvador.
Mexico, - - -	1,100,000	7,200,000	Mexico.
United States, - -	3,260,073	23,283,384	Washington.
Bolivia, - - -	318,000	1,700.000	Chuquisaca.
Brazil, - - - -	2,300,000	7,560,000	Rio Janeiro.
Chili, - - - -	144,000	1,200,000	Santiago.
Colombia, - - -	1,500,000	4,050,000	Bogota.
Guiana, - - - -	135,000	164,695	Georgetown.
La Plata, - - -	927,000	1.600,000	Buenos Ayres.
Paraguay, - - -	74,000	260.000	Assumption.
Peru, - - - -	524,000	1,400,000	Lima.
Uruguay, - - -	120,000	140,000	Monte Video.

[*] Including our possessions in Central and South America.

WEST INDIES.

The Islands called the *West Indies* include the following groups:[a]—

1. The *Bahamas*, which are about 500 in number, but many of them are mere rocks and islets. The principal islands of this group are, Providence, Bahama, and Guanahani or St. Salvador. The latter, *Guanahani*, is remarkable as being the island on which Columbus first landed, and to which he gave the name of *St. Salvador*.

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[a] The West India Islands lie between 10° and 27° north latitude, and between 59° and 85° west longitude. They contain, it is estimated, about 95,000 square miles; and a population of 3,000,000, of whom about 600,000 are Whites.

2. The *Greater Antilles*, which include Cuba, Hayti (called also Hispaniola or St. Domingo), Jamaica, and Porto Rico.

3. The *Lesser Antilles*, which lie along the northern coast of South America, nearly parallel to the Greater Antilles. The principal islands of this group are Margarita, Buen-Aire, and Curaçoa.

4. The *Caribbean Islands* are divided into three classes, namely, the *Virgin*, the *Leeward*, and the *Windward* Islands.

The Virgin Islands are—Santa Cruz, St. Thomas, St. John, Tortola, and Virgin Gorda.

The largest of the Leeward Islands are—Anguilla, St. Martin's, St. Bartholomew, Saba, Barbuda, St. Eustatius, St. Christopher, Nevis, Antigua, Montserrat, Guadaloupe, and Dominica.

The principal of the Windward Islands are—Martinique, Grenada, Tobago, Barbadoes, and Trinidad.

BRITISH WEST INDIA ISLANDS.

The principal islands belonging to *Great Britain* are—Jamaica, the Bahamas, St. Christopher's, Nevis, Antigua, Dominica, St. Lucia, Barbadoes, St. Vincent, Grenada, Tobago, Trinidad. Spanish Town, Kingston, and Port Royal, are the chief towns. They are in Jamaica.

BELONGING TO OTHER POWERS.

The *Spanish* islands are—Cuba and Porto Rico. The chief town of Cuba is Havannah; and of Port Rico, San Juan.

The *French* islands are—Martinique, Guadaloupe, Marie Galante, and the northern part of St. Martin.

The *Dutch* islands are—Curaçoa, St. Eustatius, and the southern part of St. Martin.

The *Danish* islands are—Santa Cruz, St. Thomas, and St. John.

St. Bartholomew belongs to *Sweden*.

INDEPENDENT.

Hayti (St. Domingo or Hispaniola) was taken possession of by the slaves during the French revolutionary wars, and formed into a government of Negroes, under the name of the *Republic of Hayti*. The chief towns are *Port-au-Prince*, Cape Haytien, and St. Domingo.

The people of Hayti are rapidly advancing in civilization.* Free schools and a college have been established, and foreign teachers are employed at the expense of the government.

MOUNTAINS.—The principal mountains are, the Blue Mountains in Jamaica, the Copper Mountains in Cuba, and Morne Garou (volcano) in St. Vincent.

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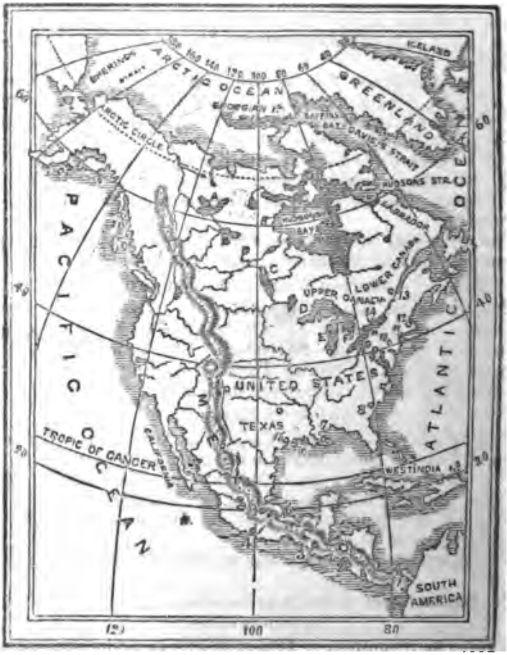
* *Hayti* is at present (1844) in an unsettled state, from political causes.

NORTH AMERICA.



References to the Map of North America.

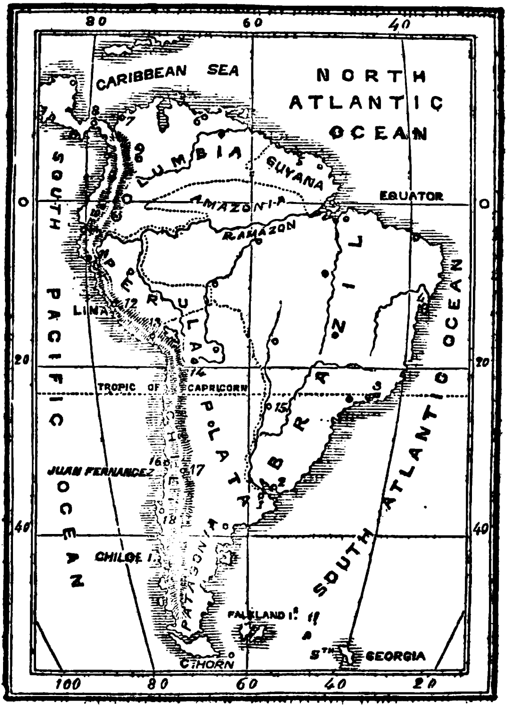
TOWNS.

Acapulco,	4	Leon,	2	Philadelphia,	10
Boston,	12	Mexico,	5	Quebec,	13
Charlestown,	8	New Orleans,	7	Toronto,	14
Guatimala,	3	New York,	11	Washington,	9
Galveston,	15	Panama,	1	Vera Cruz,	6

LAKES.

A Slave Lake.	C Winnipeg.	E Michigan.	G Erie.
B Athabasca.	D Superior.	F Huron	H Ontario.

SOUTH AMERICA.



References to the Map of South America.

Arequipa,	13	Lima,	12	St. Fe de Bogota,	9
Assumption,	15	Monte Video,	2	St. Jago,	17
Buenos Ayres,	1	Panama,	8	St. Salvador,	4
Caraccas,	6	Potosi,	14	Surinam,	5
Carthagena,	7	Quito,	10	Truxillo,	11
Conception,	18	Rio Janeiro,	3	Valparaiso,	16

OCEANICA.

OCEANICA, or the *Watery* World, is inferior to the other great divisions of the globe, both in extent and population. It consists of *Australia* or New Holland, and the adjacent islands and of *Polynesia*, or the multitudinous groups of islands in the Pacific Ocean.

The *area* of Oceanica has been *estimated* at about three millions of square miles, and the *population* at about 20 millions, but these estimates are evidently little more than conjectures.

AUSTRALIA,[a] or *Australasia*,[b] consists of New Holland, Van Diemen's Land, New Zealand, New Guinea, New Britain, New Ireland, New Caledonia, New Hebrides, Solomon's Islands, and some others.

The vast island of New Holland was discovered by the Dutch, but its eastern shores were first traced by Captain Cook, who named the place where he first landed *Botany* Bay, from the beauty and variety of the *flowers* which he found in every direction. The eastern coast of New Holland, which is called New South Wales, has been extensively colonized by the British people, particularly towards the south-east. The principal settlements are Sydney, Port Jackson, Botany Bay Port Hunter, Port Macquarie, and Port Moreton.

Another settlement has been formed upon the Swan River, on the south-western coast; and another on the south coast, which is called South Australia.

In Van Diemen's Land also there are several British settlements, the chief towns of which are Hobart Town and Dalrymple. New Zealand also is beginning to be extensively colonized by British emigrants.

The islands of *Polynesia*, as the term denotes, are exceedingly numerous. The principal groups are—the Ladrone, the Pelew, the Caroline, and the Sandwich Islands, north of the equator; and the Society Islands, the Friendly Isles, the Navigators' Islands, the Marquesas, and the Washington Islands, south of the equator.

The inhabitants of the Society, Sandwich, and Friendly Islands, from their intercourse with Europeans, have made considerable advances in civilization and Christianity. In the Sandwich Islands alone there are nearly 1,000 schools under the care of European missionaries, in which upwards of 50,000 native children are instructed.

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[a] The animals of Australia differ remarkably from those of the other divisions of the globe. Some of their *quadrupeds* walk on two feet, and others have the bill of a bird.

[b] Australasia, that is, *Southern Asia*.

GENERALIZATION OF THE
CLIMATES AND PRODUCTIONS OF THE EARTH.

INSTEAD of obliging children to learn the climates and productions of every country in the world *separately*, which even if they could, it would be impossible for them to recollect, it is much better to begin by giving them general views of the principal productions of the GREAT DIVISIONS OR ZONES. into which the earth's surface has been divided. In this way, the knowledge of a few general principles will enable them to form tolerably correct ideas of the climate and productions of every country in the world, by merely knowing the *division* or zone in which it is situated.

With this view the earth may be divided into SEVEN great CLIMATES or regions, namely, the *Equatorial*, the *Tropical*, the *Warm*, the *Temperate*, the *Cold*, the *Frozen*, and the *Polar* regions. The *isothermal* lines described in the Fifth Chapter will enable the pupils to trace the general boundaries of each of these great divisions of the earth. They should, therefore, make themselves perfectly acquainted with the general direction of each of these *lines*, and with the principal productions which characterize each *zone* or *division*. It is stated in the chapter referred to, that the *Equatorial* region extends about twenty degrees on each side of the equator, and that the most delicate spices, as cinnamon, cloves, nutmeg, and pepper, are confined to this great band of the earth. It has therefore been designated as the region of the *spices*. In like manner, the other great divisions of the earth have been designated from the principal productions by which they are characterized; as the region of the *sugar-cane* and *coffee-tree;* the region of the *fig* and *olive;* the region of the *wine-grape;* the region of the *oak* and *wheat;* the region of the *fir*, *pine*, and *birch;* and the region of *alpine shrubs*, *lichens*, and *mosses*.

It is not to be supposed that the plants and vegetables here specified, are confined to the regions which have been called by their names; still less that these are the only productions which are found in perfection in those parts of the earth. Every plant, in addition to a genial soil, requires a certain degree of temperature to bring it to maturity; and in every part of the world in which vegetables find a soil and climate suitable to their nature, there we are to expect them in the greatest perfection.

We shall now enumerate a few of the other vegetable productions by which the principal zones are characterized.

The *Equatorial* division of the earth, in addition to the finest spices, by which it is particularly characterized produces, in the greatest perfection, aromatic and medicinal gums, balsams, and juices; also myrrh, frankincense, camphor, and cassia. The guava,[*] banana, tamarind, pine-apple, and other delicious fruits abound in those regions. The bread-fruit tree, the plantain, the sago, and other species of the palm-tree; and the yam, cas'sävi, manioc, and arrow-root, serve as substitutes for wheat, oats, barley, and rye, which could not be grown in those regions, except in elevated and mountainous districts.

Rice, and maize or Indian corn, are natives of hot climates, and hence they are produced in great abundance in the equatorial and tropical regions where the soil is suitable.

In the forests of those regions are found the hardest, most durable, and most beautiful kinds of timber, as iron-wood, teak, ebony, mahogany, sandal-wood, rose-wood, &c.

In the *Tropical* regions are found, with the exception of the finest spices, all the plants and productions of the equatorial zone. And here in the greatest perfection are found the *sugar-cane*, *coffee-tree*, *cocoa-nut*, and all the other species of the palm-tree.

The orange, lemon, and citron, are found here with the most delicious flavour.

Indian corn or maize, and rice, are produced in great abundance in tropical climates; also cotton, tobacco, indigo, drugs, and dyewoods.

In the *Warm* regions, the olive and fig are found in the greatest perfection; and towards the tropical borders, the orange and lemon. Almonds, peaches, apricots, flourish here; also the mulberry, so essential to the production of silk; and the vine, from which the choicest wines are produced. Wheat, too, is produced in great perfection here, particularly towards the temperate borders.

The cork-tree, drugs, barilla, shumac, dried fruits, are products of those regions.

In the *Temperate* regions, the different kinds of grain are produced in great perfection; also the oak, beech, maple, and other trees valuable for timber.

Towards the borders of the warm regions, grapes, almonds, peaches, and apricots, are produced in perfection; also plums, cherries, apples, and pears, particularly towards the borders of the next great division.

The principal vegetable productions of the *Cold* regions are *pine* and *fir* timber, oats, barley, and rye. The fruits are apples, pears, nuts, gooseberries, strawberries, &c.

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[*] Pronounced *gwa'-va*.

In the *Frozen* and *Polar* regions, there is scarcely any vegetation; but from those parts of the world we obtain valuable *animal* productions, as whalebone, train oil, and the *furs* of commerce.

ANIMALS.

The torrid zone is as remarkable for the great number and large size of its *animals*, as it is for the rank luxuriance of its vegetables. In it are found the most *gigantic* animals, as the elephant, the hippopotamus,[a] and the rhinoceros; and the fiercest and most formidable *beasts of prey*; as the lion, the tiger, the leopard, the panther, the ounce, the hyena; and the jaguar, and puma or cougar of South America. Some of the animals, however, peculiar to those regions, are not only harmless and beautiful, but in the highest degree useful to man; as the zebra, the giraffe or camelopard, the antelope, the camel, and the dromedary; and in the new world, the lama and the vicuna.

REPTILES of the most enormous size, as the boa constrictor, and of the most venomous nature, as the cobra da copella, are natives of the torrid regions.

The LIZARD tribe are equally gigantic and formidable; as the crocodile of Africa, the alligator and cayman of America, and the gavial of India.

The whole tribe of QUADRUMANA; as baboons, apes, and monkeys, belong to those climes.

The BIRDS of those regions have usually the most brilliant and beautiful plumage; and some of them rival quadrupeds in size and strength; as the ostrich, the cassowary, and the condor.

Even the INSECTS in those regions are formidable, from their number and destructive powers. Locusts, and even flies, often lay waste countries, and drive nations before them.

The seas in those climates abound in FISH, most of which shine with brilliant and beautiful colours; and some of them, as the shark, display the ferocity of the wild beasts of the forests. The SHELL FISH are larger and much more brilliant than those of the more temperate climes.

TEMPERATE REGIONS.

In the temperate zones the animal tribes diminish in number, size, and ferocity. The beasts of prey are chiefly the wolf, the wild bear, and the wild cat. Domestic animals, however, as the ox and the horse, are reared in great perfection in these regions.

The REPTILE tribes gradually diminish in the temperate regions, and, as we approach the frigid zone, they disappear altogether.

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[a] Some of these animals seem confined to particular parts of the torrid zone, and some of them are found a considerable way beyond it, but with diminished size and ferocity. Thus, the hippopotamus seems peculiar to the rivers of Africa, and the two-horned rhinoceros to the southern part of the same continent. Africa is also the peculiar abode of the royal lion; those which are found in India, and some other parts of Asia, are much smaller, and nearly destitute of a mane. The royal tiger is peculiar to India, though it sometimes strays as far northward as Chinese Tartary.

POLAR REGIONS.

In approaching the 60th degree of latitude, the animals of the temperate regions become small and stunted; and a little beyond this their place is supplied by a new creation of animals; as the elk, the reindeer, the moose-deer, the martin, the sable, the ermine, &c. But in approaching the polar or frozen regions, fierce and formidable animals are found, as the white bear, the walrus, and other monsters of the deep. See note, page 103.

MINERALS.

The distribution of minerals does not, like that of animals and vegetables, depend upon climate; hence, they are found in every part of the globe; and, it is remarkable, that those which are the most useful to man are the most widely distributed, and found in the greatest abundance. It is also remarkable, that those portions of the earth which are found to be unfit for the support of animal and vegetable life, are usually rich in mineral treasures. *Gold*, the most precious of all the metals, is found in all the great divisions of the globe, but principally in South America.[a]

Mexico and Peru produce gold in far greater abundance than any other countries in the world. Brazil also produces large quantities of gold, both from alluvial sands and mines. Africa furnishes large quantities of gold. It is found chiefly in the sands of the rivers in Western Africa or *Guinea*, and in countries about the *Gold* Coast. It is also found on the coast of Zanguebar, and in the mountains behind Mozambique.

Gold is found in many parts of Europe, but no where in large quantities. Alluvial gold has been found in Ireland, Scotland, and several countries of Europe; and the sands of the Danube, the Tagus, the Rhine, the Rhone, and the Garonne, contain small quantities of it. The mines of Kremnitz, in Hungary, are usually considered the most important; but the recently discovered mines in the Ural Mountains are far more productive. See page 175. Gold is also found in Siberia or Northern Asia; and in the islands of Sumatra, Borneo, Celebes, &c.

Platina is a very scarce metal. It is usually found in connexion with gold; as in the gold washings of South America, and in the Ural Mountains, from which the principal supplies of it are obtained.

Silver, as well as gold, is found in unequalled abundance in Mexico and South America, particularly in Peru, Chili, and Buenos Ayres. It is usually found in ores, but frequently pure, and in large masses.[b]

The most valuable silver mines in Europe are those of Schemnitz and Kremnitz, in the Austrian dominions. The mines of Kongsberg, in Norway, have produced large masses of pure silver. It is also found, but in small quantities, in several other countries of Europe. See page 175.

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[a] It is usually found in a perfectly pure state, either in small masses, or in grains or gold dust; and more than the half of the whole quantity obtained is found in alluvial soils, near the base of great mountain ranges, or in the sands of rivers. The remainder is extracted from mines.

[b] The celebrated Potosi mines were accidentally discovered by an Indian. In climbing up the mountain, he caught hold of a small bush, which giving way, presented to view, under its roots, large masses of silver. Huantaya in Peru, and Guanaxuato in Mexico, are the most productive mines. The latter has a vein of silver ore 180 feet wide and 1,600 feet deep.

Silver is also found in several parts of Siberia, and in China and Japan.

Scarcely any silver has been found in Africa; but scarcely any mining attempts have been made there.

Iron, the most useful of all the metals, is the most widely and the most abundantly distributed. It is found in almost every country in the world, but more extensively in the temperate than in the tropical regions. The principal ores are the magnetic ore and iron-stone of mountainous regions; and the bog-iron, and iron earth, of alluvial districts. The most extensive iron mines in the world are in Great Britain. France has also very extensive iron mines. Sweden contains large mines of magnetic iron-stone, which produces the best bar-iron. In Swedish Lapland, at Gellivara, there is a mountain of iron-ore three miles in length. Norway and Russia have also extensive iron mines. Elba contains one of the most ancient mines of iron, the ore of which is remarkable for the beautiful play of its colours.[*] In the United States, particularly along the Alleghanies, there are numerous and inexhaustible beds of iron-ore.

Copper ranks next to iron in utility. It is found in most regions of the globe, and often in pure metallic masses. England has the most extensive copper mines in the world. In Cornwall, in particular, this metal is most abundant. There are also considerable mines in Norway, Sweden, Austria, and Russia; but England produces as much as all the rest of Europe. Copper is also found in Siberia and Chinese Tartary. Japan produces copper of superior excellence. This metal is also found in Morocco, Nigritia, and in Southern Africa. It is also found in the southern part of South America, and in the northern extremity of North America, about the mouth of the *Coppermine* River.

Zinc, the metal which is combined with copper to form *brass*, is found in many countries in considerable quantities.

Lead is found more or less in almost every country. In Peru, and the Ural Mountains, it is very rare, though other metals are abundant. It is found in large quantities in the British Islands, and is very abundant in Spain. There are also considerable mines of this metal in France, Austria, and Germany; but Great Britain and Spain supply, in nearly equal proportions, about six-sevenths of all the lead produced in Europe.

The lead mines in Missouri, near the Mississippi, are said to be the richest in the world. The ore is found abundantly, a foot or two from the surface, in detached masses, weighing from one to 1,800 pounds.

Tin is found in few countries. The most extensive, and the most ancient mines in the world, are in Cornwall in England. The mountains of Saxony, Bohemia, and Galicia in Spain, supply considerable quantities; but England yields about twelve-thirteenths of all the tin produced in Europe.

Tin is found in Mexico and Chili, but in small quantities. It is also found in India, Malacca, Japan, Sumatra, and particularly in the island of Banca, in the neighbourhood of Sumatra.

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[*] Insula inexhaustis chalybum generosa metallis.—*Æneid*, x. 174.

Mercury, or *quicksilver*, is found in several parts of the globe, but only in small and detached portions. The principal mines are in Idria in Hungary. There are also mines at Almaden, near Cordova in Spain, Deuxponts in Germany, and Guenca Velica in Peru. Mercury is also found in Mexico, New Grenada, and China.

Cobalt, which is chiefly used for giving a blue colour to glass and porcelain, is procured principally from Germany.

Arsenic is found in most of the mining districts of Europe; but it is chiefly obtained from Germany, and the countries on the Mediterranean. Some of its ores form brilliant colours for the painter.

Antimony and *bismuth* are brittle metals. They are combined with lead to form the metal of which printing types are made. They are also principally obtained from Germany.

The other metals described by the mineralogists, as *manganese*, *nickel*, &c., are of less importance.

COMBUSTIBLE OR INFLAMMABLE MINERALS.

Coal, of all the mineral treasures, is perhaps the most important. It is found in the greatest abundance in England and Scotland. It is also found in Belgium, Prussia, and France. See page 175.

Coal is also found in great abundance in many parts of America, as in Cape Breton, New Brunswick, Pennsylvania, &c. Humboldt found coal at a very great elevation in the Andes. Coal is also found in large quantities in China.

Sulphur is most abundant in volcanic countries; and seems to be an important part of the fuel which feeds their fires. It exudes from the earth in volcanic districts, as in the Solfa Terra of Naples, and is principally found in the craters of extinct volcanoes. Sicily, Naples, and Iceland, abound with it. It is also found in Spain, and in some of the West India islands, as Guadaloupe, Martinique, and Montserrat. It is also often collected in considerable quantities from *sulphureous* springs.

Amber is found frequently in alluvial districts; but it is procured almost entirely from the coasts of Prussia.

The other inflammable minerals, as *naptha*,[*] *petroleum* or mineral oil, and *bitumen* or mineral pitch, are found in many parts of the world, but principally in Asia. They are used for lamps, for medical purposes, for varnish, and, anciently, for cement.

SALINE MINERALS.

Salt is a mineral of the utmost importance to man, and is found in every part of the world in great abundance. The ocean itself is an inexhaustible mine of salt, from which, in warm countries (as in the

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[*] *Naptha* is bitumen in its purest state. It is a whitish transparent fluid. *Petroleum* is bitumen in an oily or less pure state; and *asphaltum* is bitumen in a pitchy or hardened state. *Baku*, near the Caspian Sea, is celebrated for its bituminous springs. The soil, for several miles round, so abounds with naptha and petroleum, that wells dug in the sand yield large quantities daily. And in Burmah, near Rangoon, there are petroleum springs which furnish, it is stated, about 10,000 hogsheads annually for commerce. Petroleum is also found in Modena and Parma in Italy. Asphaltum is found floating on the surface of the Dead Sea in large quantities; and the Pitch Lake, in the Island of Trinidad, is often covered over with it like a crust.

Cape Verde Islands), it is formed by the heat of the sun, and in colder regions, by means of artificial heat. In Cheshire in England, there is an extensive bed of salt, from 60 to 90 feet thick. In France, Germany, and Hungary, there are also extensive mines; but those of Wielitzka, near Cracow in Poland, are the most extensive and the most celebrated in the world.

Salt sometimes forms *mountains*, as at Cardonna, near Montserrat, in Spain. In Moldavia in Turkey, there is also a mountain of salt; and in Hindostan, there is a range of hills entirely composed of salt, extending across the Indus, through Cabul. There are also large *plains* incrusted or covered with salt, in many parts of the earth, as in Abyssinia, the Sahara, Persia, the Desert of Atacama, Siberia, &c. See page 67.

Salt or *brine springs* are also numerous in many parts of the world. They are formed by passing through beds of salt.

Nitre is found in large quantities in several of the plains of Spain, Hungary, Russia, and Persia.—See page 68. It is also found in the earth of calcareous caves, in India, Java, Naples, &c.

Borax, a salt used in soldering metals, is found in lakes and caverns in Tibet, Persia, Hungary, &c.

Ammonia, or volatile salt, is found principally in the neighbourhood of volcanoes; as in Iceland, Naples, Sicily, and the Lipari Isles.

Soda, or *barilla*, is obtained from the ashes of marine plants. It is procured principally from Spain and other countries on the Mediterranean. It is also found in beds, as in La Plata. Soda is also calle *natron*. See page 73.

The following TABLE, which exhibits at one view the chief productions and EXPORTS of the principal countries in the world, illustrates the GENERAL PRINCIPLES just laid down.

Countries.	*Exports.*
Asiatic Islands,	Cinnamon, cloves, nutmegs, pepper, ginger.
Hindostan,	Cotton goods, silk, sugar, coffee, pepper, indigo, rice, lac-dye, saltpetre, precious stones.
Birman Empire,	Teak timber, rice, indigo, gums, drugs, palm sugar, cotton goods, silk, varnish.
China,	Tea, silk, cotton goods, porcelain, lacquered ware gums, paper, drugs.
Japan,	Silk and cotton goods, drugs, spices, varnish, porcelain, rice, cedar.
Persia,	Silks, carpets, cotton goods, shawls, stuffs, sugar rice, dried fruits, leather, drugs, tobacco.
Arabia,	Coffee, aloes, gums, myrrh, frankincense, perfumes, drugs.
Africa,	Palm-oil, teak-timber, aloes, dye-woods, ostrich feathers, ivory, gold, sugar (from the Mauritius).
Turkey in Asia,	Coffee, carpets, silks, fruits, drugs, opium.
West Indies,	Sugar, coffee, rum, molasses, cotton, pimento, ginger, logwood, mahogany, cocoa, cochineal. cigars.
Mexico,	Silver and gold.

Caraccas,	Cocoa, coffee, indigo, tobacco.
Guiana,	Sugar, rum, cotton, coffee, tobacco, indigo, cayenne-pepper.
Brazil,	Cotton, sugar, coffee, tobacco, dye-woods, drugs from the northern provinces; gold and diamonds from the middle; and wheat, hides, and tallow from the southern.
Buenos Ayres,	Gold and silver, hides, beef, tallow.
Peru,	Silver and gold.
Chili,	Silver, gold, and copper, from the northern provinces; wheat and hemp from the southern.
Morocco,	Leather, goat-skins, gums, fruits.
Algiers and Tripoli,	Ostrich feathers, dates, wax, wool.
Egypt,	Cotton, indigo, drugs, fruit, rice.
Madeira Islands,	Wine, fruits.
Canary islands,	Wines, fruits, silk, barilla.
Turkey and Greece,	Figs, raisins, currants, raw silk, oil.
United States:	
Southern States,	Cotton, tobacco, rice.
Middle States,	Wheat, flour; and from Maryland, tobacco.
Northern States,	Timber, fish, beef, pork, pot and pearl ashes.
Spain and Portugal,	Olive-oil, wines, raisins and other dried fruits, lemons, oranges.
Italy,	Thrown silk, olive-oil, currants, lemons, oranges, wine, barilla, shumac, cheese, straw-hats.
France,	Wines, brandy, silk (raw and manufactured), gloves, madder, fruits.
Germany,	Wool, corn, wines, linens, clover and rape seeds, wooden clocks.
Netherlands,	Fine linen, lace, butter, cheese, corn, madder, geneva, flax, seeds, toys.
Great Britain,	Cottons, woollens, linens, hardware, salt, coals, iron and steel, earthenware, glass, machinery, fire-arms.
Ireland,	Cattle, corn, linen, beef, bacon, butter, hides.
Prussia,	Corn, timber, flax, bark.
Denmark,	Corn, rape-seed, fish, hogs.
Sweden,	Timber, iron, bark.
Norway,	Timber, turpentine, fish.
Russia,	Tallow, corn, flax, hemp, flax-seed, ashes, timber, tar, furs.
Canada,	Timber, corn, pot and pearl ashes, furs.
Newfoundland,	Cod-fish.
Nova Scotia,	Timber, dried fish, plaster of Paris.
Hudson's Bay,	Furs, procured from the Indians.
Columbia River,	Furs, procured from the Indians.
Kamtschatka,	Furs and dried fish.
Siberia,	Furs and minerals.
Greenland,	Whale-oil, whale-bone, the produce of the Fisheries.

SACRED GEOGRAPHY.

Palestine, or the **Holy Land**, is properly a part of Syria.[a] It is bounded on the north by Phœnicia and Syria;[b] on the east by Syria and Arabia Deserta; on the south by Arabia Petræa; and on the west by the Mediterranean Sea.

This tract of country was originally inhabited by the descendants of Canaan, the grandson of Noah, and hence it was called the *Land of Canaan*.[c] It was afterwards called Palestine, from the *Philistines*,[d] who occupied the southern coasts; and Judea, from *Judah*, the chief tribe of the Israelites. It was also called the Land of Promise, the Holy Land, &c.

The limits of the country to which these names were applied, varied at different times; but, generally speaking, the greatest length of Palestine was nearly 200 miles; and its greatest breadth about 100 miles.

Palestine was differently divided at different times. When Joshua took possession of it, he divided it among the twelve tribes of Israel — Reuben, Simeon, Judah, Issachar, Zebulun, Manasseh, Ephraim,[e] Benjamin, Dan, Naphtali, Gad, Asher.

LOCATION OF THE TWELVE TRIBES.

Between the Dead Sea and the Mediterranean, were the tribes of Judah, Simeon, and Dan.

On the west side of the Jordan, were the tribes of Benjamin, Ephraim, half tribe of Manasseh, and the tribe of Issachar.

On the east side of the Jordan, were the tribes of Reuben, Gad, and the half tribe of Manasseh.

On the western side of the Sea of Galilee, were the tribes of Zebulun and Naphtali.

North-west, on the Mediterranean, was the tribe of Asher.

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[a] Syria, generally speaking, lies between the Euphrates on the east, the Mediterranean on the west, Mount Taurus on the north, and Arabia on the south.

[b] A line drawn from Damascus to a little to the southward of Tyre, will give its northern boundary. It extends from 31° to 33° 35′ N.L.; and from 34° 30′ to 36° 25′ E.L.

The Sidonians, Hittites, Jebusites, Amorites, Hivites, &c., were also the descendants of Canaan, and the name *Canaanites* was originally applied to all; but it was afterwards restricted to a particular tribe (Numb. xiii. 29.)

[d] The Philistines were descended from Mizraim, the second son of Ham, and were originally settled in Egypt; whence they emigrated, and possessed themselves of all the country from Gaza to Joppa.

[e] Manasseh and Ephraim were properly a single tribe, being descendants of Joseph. The tribe of Levi had no portion assigned to them. They subsisted on offerings, first-fruits, and tenths; and particular cities in the land of each tribe were appointed for their habitations.

It was afterwards divided[a] into the two kingdoms of Judah and Israel; and lastly by the Romans into four provinces or districts, namely, Galilee, Samaria, Judea Proper, and Peræa, or the Country beyond the Jordan.

In GALILEE,[b] the chief places were — Cana, Chorazin, Capernaum, Bethsaida, Tiberias, Bethlehem, Nazareth, Nain, Zebulun, Accho or Ptolemais, now Acre.

In SAMARIA,[c] the chief towns were — Samaria, Sychem or Sychar, and on the coast, Cæsarea and Joppa.

In JUDEA, the chief towns were — Jerusalem, Jericho, BETHLEHEM, Ephraim, Bethel: also, Gaza, Gath, Ascalon, Azotus or Ashdod, and Ekron, in the country of the Philistines.

In PERÆA, or the COUNTRY BEYOND THE JORDAN, the chief towns were — Cæsarea Philippi, Bethsaida or Julias, and Bethabara.

South of the Dead Sea was Idumæa or Edom, and the Land of Midian; but these countries are properly a part of Arabia.

MOUNTAINS.—On the north, *Libanus* or *Lebanon*, divided into two ranges — Libanus on the west, and Anti-Libanus on the east; *Hermon*, *Mount Carmel*, *Gilead*, *Tabor*, *Gilboa*, the mountains of *Abarim*, the most remarkable of which are, the *Heights of Baal*, *Pisgah*, and *Nebo*, on which Moses died. *Mount Seir* is in Idumæa or Edom; and *Mount Sinai*, between the two branches of the Red Sea. *Horeb* adjoins Sinai, and is, in fact, a peak of the same mountain.

RIVERS. — The *Jordan*,[d] which rises in the mountains of Anti-Libanus, and flows through the waters of Merom, and the Sea of Galilee into the Dead Sea; the *Waters of Lebanon*, which flow into the Mediterranean; the *Arnon*, which rises in the chain of Gilead, and falls into the Dead Sea; the *Kishon*, which flows into the Mediterranean, north-east of Mount Carmel; and the Brooks *Jabbok*, *Kedron*, &c.

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[a] In consequence of the revolt of the ten tribes in the reign of Rehoboam the son of Solomon. The tribes of Judah and Benjamin, which alone remained faithful to the house of David, formed the kingdom of Judah; the other ten tribes, the kingdom of Israel.

[b] The Galileans were composed partly of the remnant of the ten tribes, and partly of Gentiles. Hence, the Jews (of Judah and Benjamin) regarded them as an inferior and degenerate race. In Galilee our Saviour spent the greater part of his life; it was the scene of many of his miracles, and from its inhabitants he selected most of his disciples.

[c] When the ten tribes were carried away captive into Assyria, a number of Assyrians were introduced into their country, who mingled with the Israelites that were left, and with those who afterwards returned. Hence, the Jews (who called them Samaritans, from *Samaria*, their capital) regarded them as little better than Gentiles, and the greatest aversion existed between the two nations. The separation of the ten tribes, the opposition of the Samaritans to the rebuilding of the Jewish temple after the Babylonish captivity, and their ill-treatment of the Jews who passed through their country to worship at Jerusalem, instead of going to Mount Gerizim, account for the hatred and hostility between the two nations.

[d] *Jordan*, that is, the *river of Dan*, so called from a town near its source.

Lakes.—The *Dead Sea*,[a] the *Sea of Galilee* or *Tiberias*,[b] called also the *Lake of Gennesareth*; the *Waters of Merom*.

ANCIENT GEOGRAPHY.

THE PRINCIPAL COUNTRIES KNOWN TO THE ANCIENTS.

ASIA.

Chaldæa, in the earliest ages of the world, comprised the countries between the Euphrates and Tigris near their junction; but the name was afterwards given to the country south-west of the Euphrates. Chaldæa may be regarded as the cradle of mankind, as it was in that part of the earth that the garden of Eden was situated. It was afterwards called Babylonia, from its metropolis *Babylon*, the most celebrated city of antiquity. This country is now called Irak-Arăbi, and the chief cities are *Bagdad* and *Bassŏra*.

Assyria originally meant the country to the east of the Tigris; but the name was afterwards frequently extended to Syria. Assyria took its name from *Asshur*, one of the descendants of Shem. Its chief city was the celebrated *Nineveh*, which stood on the banks of the Tigris, near, it is supposed, the site of the village of *Nounia*, in the neighbourhood of Mosul.

Syria comprised all the countries between the Euphrates and the Mediterranean on the one hand, and between Arabia and the branches of Mount Taurus on the other. *Damascus*, which existed in the days of Abraham, was the chief city of Syria. It is still a large and flourishing town. Between the Orontes and the Euphrates, about 170 miles north-east from Damascus, stood *Palmyra* or "Tadmor in the Desert." Its magnificent ruins are scattered over an extent of several miles. *Baalbec* or *Heliopolis*, that is, the city of the sun, is also celebrated for its magnificent ruins, particularly for a temple of the sun. Its site is about forty miles south-west of Damascus.

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[a] *Dead Sea.*—This lake is also known in Scripture by the names of the *Salt Sea*, the *Sea of the Plain*, and the *East Sea*. The Greeks called it *Asphaltites*, from the sulphurous and bituminous matter which it casts upon its shores; and with which its waters are deeply impregnated. The appearance of this sea, and of the whole scenery about it, is dreary, desolate, and *death-like*. It varies in extent, according to the season of the year, from about 40 to 60 miles in length; and from about 10 to 15 miles in breadth.

[b] *Sea of Tiberias.*—This is a fresh water lake, about 16 miles long, and from six to nine broad.

About 120 miles north-north-east of Damascus, and 76 miles east-south-east of Iskenderoon, stood Berœa, now *Aleppo*, a city of great wealth and importance when the trade of Europe and the East was carried on overland.

To the west of Damascus, in that part of Syria called Phœnicia, were the celebrated commercial cities of *Tyre* and *Sidon;* and farther to the south, *Joppa*, now *Jaffa*, where Jonah embarked for Tarshish, and at which Solomon imported the materials for the Temple.

On the Orontes, about twelve miles from the coast, was the rich and populous city of *Antioch*,[a] where the disciples of our Lord were first called CHRISTIANS: and near the mouth of the same river, the seaport, *Seleucia*,[a] from which St. Paul embarked for Cyprus in his first apostolic journey.

MESOPOTAMIA[b] was the name given to the tract of country *between the rivers* Euphrates and Tigris. The southern part of this country, near the junction of the rivers, was included in the ancient *Chaldæa* or *Babylonia*. In Mesopotamia was *Ur* of the Chaldees, from which Abraham was called to the land of Canaan, (the country between the river Jordan and the Mediterranean Sea). In the north-west of Mesopotamia was *Haran* or *Charræ*,[c] and *Edessa*.

ARMENIA,[d] which still retains its name, lies to the north of the ancient Mesopotamia. It consists principally of mountainous regions; and in it are the sources of the rivers Euphrates, Tigris, Cyrus or *Kur*, and Araxes or *Aras*. The chief towns were *Tigranocerta* and *Artaxata*. In Armenia is the celebrated Mount Ararat, on which Noah's Ark first rested.

COLCHIS, ALBANIA, and IBERIA, lay to the north of Armenia, between the Euxine and Caspian Sea. These countries, which are intersected by the Caucasian mountains, now include Georgia, Mingrelia, and part of Circassia.

At the mouth of the Phasis stood a city of the same name, the capital of Colchis, celebrated in fable for the expedition of Jason in search of the Golden Fleece.

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[a] There were several other cities called *Antioch* and *Seleucia*.

[b] *Mesopotamia*. This term is derived from two Greek words which signify in the *middle* or between the *rivers*. In like manner, the terms *Punjab* and *Doab* in Hindostan, signify, the one *between* the *five*, and the other *between* the *two rivers*. Compare also *Senegambia* (that is, between the *Senegal* and *Gambia*), in Africa; and *Entre Douro e Minho*, in Portugal.

[c] *Haran* is mentioned in Genesis xi. 31. It was here Crassus was defeated and slain by the Parthians. The Romans called it *Curæ*.

[d] *Armenia* took its name from *Aram*, the fifth son of Shem.

Media lay to the south of the Caspian Sea, and north of Persia. Its chief town was *Ecbatăna.*

Persia, which still retains its name, lay to the north of the Persian Gulf, and to the south of Media; but it was afterwards greatly extended. Its ancient name was *Elam*, from being first inhabited by the descendants of Elam, the eldest son of Shem. The chief towns were, *Persepŏlis*, *Susa*, and *Elymais.*

Arabia still retains its ancient name and divisions, namely, Arabia *Deserta*, *Petræa*, and *Felix.*

In Arabia was the land of Uz, the country of Job; also Edom or Idumæa, the land of Midian, and Saba, the country of Sheba, the "Queen of the south."[a]

In the tongue of land between the northern branches of the Red Sea, were Mounts Sinai and Horeb; and at the top of the eastern branch stood *Ezion-Geber*, from which the ships of Solomon sailed to Ophir.[b] At the top of the western branch stood *Arsinŏe* or *Cleopatris*, now *Suez.*

Asia Minor consists of the great western projection of Asia between the Euxine or Black Sea on the north, the Mediterranean on the south, and the Ægean or Archipelago on the west. The term Asia Minor does not occur in classic writers, but was first applied in the middle ages.

The Romans divided this part of Asia into *Asia cis* or *intra Taurum*, and *Asia ultra* or *extra Taurum.*

DIVISIONS OF ASIA MINOR.

In the north—Pontus, Paphlagonia, and Bithynia.

In the west—Troas, Mysia, Æolis, Ionia, Lydia, and Caria.

In the south—Lycia, Pamphylia, Pisidia, Isauria, and Cilicia.

In the east—Cappadocia and Armenia Minor.

In the middle—Galatia, Phrygia, and Lycaonia.

The chief cities in Asia Minor were, *Ilium* or Troy in Troas; *Ephĕsus* in Ionia, celebrated for the temple of Diana, one of the Seven Wonders of the world;[c] *Smyrna*, also in Ionia, still a flourishing city; *Sardis* and *Philadelphia* in Lydia; *Halicarnassus* in Caria, where Herodŏtus the father of history was born, and Mausōlus[d] was buried, whose *tomb* was another of the Seven Wonders of the world: *Cnidus*, also in Caria, in which was a celebrated statue of Venus, made by Praxitĕles; *Patăra* and *Xanthus* in Lycia; *Perga* in Pamphylia; *Tarsus* in Cilicia, the birth-place of St. Paul; *Issus*, also in Cilicia, where Alexander defeated Darīus; *Iconium*, *Derbe*, and *Lystra*, in Lycaonia, where St. Paul was stoned; (Acts xiv. 19.) *Gordium*[a] and *Laodicēa* in Phrygia; *Chalcēdon* in Bithynia, now called Scutári; *Nicæa*, now Nice, also in Bithynia, famous for the first general council held there in 325; *Sinōpĕ*, in Paphlagonia, the birth-place of Diogenes; *Trapezus*, now Trebizond, in Pontus; and *Cerăsus*, whence Lucullus is said to have first brought the *cherry*-tree into Italy.

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[a] *Saba* or *Sheba* was in the south-western extremity of Arabia Felix, which, in the time of our Saviour, was considered by the Jews as the most distant land to the southward; and hence she is described as coming from the *uttermost part of the earth.*

[b] *Ophir* is supposed to have been a port in *Sofala*, on the south-eastern coast of Africa.

[c] Hence the term *mausoleum*, which was first applied to his tomb. The five other Wonders were the Pyramids of Egypt; the Walls and Hanging

Of the *northern* and *eastern* countries of Asia scarcely any thing was known by the ancients; the former the Romans called by the general name of *Scythia*, and the latter they divided into *India intra Gangem*, (within, or on this side the Ganges,) and *India extra* (beyond) *Gangem*.

AFRICA.

EGYPT, which still retains its ancient name, was a civilized and powerful nation even in the days of Abraham. It was first inhabited by Ham and his descendants; and hence it was called by the Jews *Mizraim*,[b] or the land of Ham.

The chief cities were—*Memphis*, which stood on the Nile, about a hundred miles from its mouth, near the locality of Grand Cairo, its present capital; *Thebes*, famous for its hundred gates, about two hundred miles farther up the river; and a little below Thebes, *Coptos*, once the great emporium of Arabian and Indian commerce.

Towards Ethiopia, nearly under the tropic of Cancer, was *Syēnĕ*; near the mouth of the eastern channel stood *Pelusium*, now Damietta; and at the mouth of the western channel *Canōpus*, now Rosetta. About fifteen miles to the west of Canōpus, between Lake Mareōtis and the island of Pharos, which was joined to the mainland by a mole or causeway nearly a mile long, stood the celebrated city of *Alexandria*; so called from its founder, Alexander the Great. It was subsequently called *Scanderoon*, but it has again resumed its ancient name.[c]

The other ancient divisions of Africa were Lybia, Ethiopia, Regio Syrtica, Africa Propria, Numidia, Mauritania, and Gætulia.

Gardens of Babylon; the Labyrinth of Egypt; the Colossus of Rhodes; and the Statue of Jupiter Olympus at Athens, 75 feet high, sculptured by Phidias in ivory and gold.

[a] Where Alexander cut the famous Gordian knot, instead of untying it.

[b] *Mizraim*, a son of Ham.

[c] *Scanderoon* is a corruption of Alexandria.

Lybia lay to the west of Egypt, and extended along the coast as far as the Great Syrtis. In the north-west of Lybia was a noted city called *Cyrēne*, whence the territory adjoining was called *Cyrenaica*, or "the country about Cyrene."

Ethiopia lay to the south of Egypt along the Nile. It includes Abyssinia and Nubia.

Regio Syrtica lay between the *Syrtis Major* (Gulf of Sidra) and *Syrtis Minor* (Gulf of Cabes.) It was afterwards called Tripŏlis or Tripolitana, from its three principal cities.[a] It is now called Tripoli.

Africa Propria comprised the territory of the ancient and celebrated Carthage. Its other cities were Utica, Hadrumētum, Thapsus, and Tunis, which is about fifteen miles to the east of the site of the ancient Carthage.

The chief towns of Numidia were Cirta, Tabrăca, and Hippo Regius.

The chief towns of Mauritania were Cæsarēa and Tingis, now Tangier.

South of Mauritania lived the Gætūli, and Garymantes, of whose country little was known.

West of Gætulia were the *Insulæ Fortunatæ* or Fortunate Islands, one of which was called *Canaria*, from the number of large dogs (*canes*) found in it. They are now called the *Canary Isles.*

North of the Fortunate, were the *Insulæ Purpurariæ*, discovered by Juba, who there set up a manufacture of *purple.* They are now called the *Madeiras.*

EUROPE.

ANCIENT DIVISIONS OF EUROPE.

Græcia or Greece, which, generally speaking, comprehended the Peloponnesus, Græcia Propria, Thessalia, and Epīrus.

Italia or Italy, the three principal divisions of which were Italia Propria in the middle; Magna Græcia in the south; and Gallia Cisalpina in the north.

Hispania or Spain, and **Lusitania** or Portugal. Spain was also called *Iberia*, and from its *western* situation, *Hesperia.*

Gallia or Gaul was divided into *Gallia Cisalpina*, or the northern part of Italy; and Gallia *Transalpina*, or the modern France, Belgium, Switzerland, and part of Germany. Transalpine Gaul was divided into three parts, *Celtica*, *Belgica*, and *Aquitania.*

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[a] Namely, *Septis*, *Œa*, and *Sabrata.*

GERMANIA or Germany, which, generally speaking, included the country between the Rhine and the Vistula, the Danube, and the Baltic.

BATAVIA, now Holland or the Netherlands.

SCANDINAVIA, now Denmark, Sweden, Norway, Lapland, and Finland.

SARMATIA, which comprehended Russia, Poland, and part of Prussia.

DACIA, now Moldavia, Wallachia, and Transylvania.

MŒSIA, now Servia and Bulgaria.

THRACIA or Thrace, now a part of Roumelia.

ILLYRICUM, now Dalmatia, Bosnia, Croatia, and Sclavonia.

PANNONIA, now Hungary; NORICUM, now Austria; HELVETIA, now Switzerland; RHÆTIA and VINDELICIA, now the Tyrol and Country of the Grisons.

BRITANNIA,[*] or England; CALEDONIA, or Scotland; and HIBERNIA, or Ireland.

ISLANDS.—*Sicilia* or Sicily; *Sardinia; Creta*, now Candia; *Melĭta*, now Malta; *Baleāres* or Balearic Isles, now Majorca, Minorca, and Iviza; *Eubœa*, now Negropont, &c.

PENINSULAS.—Chersonesus *Cimbrica*, now Jutland; *Peloponnesus*, now the Morea; Chersonesus *Taurica*, now the Crimea.

SEAS.—*Mare Magnum* or *Internum*, now the Mediterranean; *Sinus Codānus*, now the Baltic; *Oceănus Cantabricus*, now the Bay of Biscay; *Mare Ægæum*, now the Archipelago; *Pontus Euxinus*, now the Black Sea; *Palus Mæōtis*, now the Sea of Azof; *Propontis*, now the Sea of Marmŏra, &c.

RIVERS.—*Rha*, now the Volga; *Danubius* or *Ister*, the Danube; *Tanăis*, the Don; *Borysthĕnes*, the Dnieper; *Padus* or *Eridănus*, the Po; *Rhenus*, the Rhine; *Rhodănus*, the Rhone; *Albis*, the Elbe; *Ibĕrus*, the Ebro; *Liger* or *Ligĕris*, the Loire; *Sequăna*, the Seine; *Bætis*, the Guadalquiver.

LAKES.—*Lemānus*, Geneva; *Brigantinus*, Constance.

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[*] When the Romans invaded Britain it was divided into a number of small independent states or tribes. The principal of these were the *Cantii*, inhabiting Kent; the *Trinobantes*, Middlesex; the *Belgæ*, Hampshire, Wiltshire, and Somersetshire; the *Durotriges*, Dorsetshire; the *Damnonii*, Devonshire and Cornwall; the *Silures*, South Wales; the *Ordovices*, North Wales; the *Iceni*, Essex, Suffolk, Norfolk, &c.; the *Brigantes*, Yorkshire, &c.

The Romans divided the country into two parts, *Romana* and *Barbara*, of different extent at different times, according to the progress of their conquests. Britannia Romana they further divided into *Prima*, *Secunda*, *Superior*, *Inferior*, &c.

The names of the principal rivers were, the *Tamesis* (Thames), *Sabrina* (Severn), *Abus* (Humber, &c.), *Vedra* (Wear), *Tina* (Tyne), *Ituna* (Eden), &c.

The principal islands were, *Vectis* (Wight), *Mona* (Anglesey), and *Mona* or *Monæda* (Man).

QUESTIONS ON THE MAP OF THE WORLD.

1. What have you before you? 2. What is a *map?* 3. What is a *globe?* 4. How much of a globe can you see at once? 5. How might you see it all at one view? (By dividing it into two equal parts or *hemispheres*, and by placing them on a table or against a wall, with their edges in contact.) 6. Is not a *map* of the *world* intended to represent a *globe*, so divided and so placed? 7. In looking at a globe or a map, where is the observer supposed to be?[a]

8. What is *Geography?* 9. How is the *earth* divided? 10. What parts of the map before you represent *land?* 11. Point to the parts which represent *water*. 12. Is there more water than land upon the surface of the earth? 13. How much more do you think? 14. What do you mean by *two-thirds?* 15. The two-thirds of a shilling are? 16. Of a yard? 17. Of a foot?

18. What is the *Equator?* 19. Why is it so called? 20. How does it divide the earth? 21. Why are they called *hemispheres?* 22. Why *northern* and *southern?* 23. Why the *top* of the map called the *north?*[b] 24. The bottom, or the part opposite to the north, is called? 25. Point to the east, west, north-east, north-west, south-east, and south-west of the map. 26. How do you find the four cardinal points of the horizon? 27. Point in the direction of the north, south, east, west, north-east, &c.[c]

28. Is there more land north of the equator than to the south of it? 29. How much more do you think? 30. How many great divisions of *land* are there on the earth's surface? 31. How many of *water?* 32. Name, and point out the five great divisions of land. 33. Name, and trace with the pointer, the five great divisions of water? 34. Which of the great divisions of land are in the northern hemisphere or north of the equator? 35. How are the others situated with regard to the equator? 36. Which of the oceans, or great divisions of water are in both hemispheres? 37. Which is confined to the northern, and which to the southern hemisphere?

38. What is a *continent?* 39. What is an *ocean?* 40. Name the continents in the order of their size. 41. Name the oceans in like manner. 42. Europe, Asia, and Africa are sometimes called? 43. Why is America called the western continent? 44. Why the New World? 45. Oceanica comprehends? 46. What is meant by the term *Australia?* 47. What by *Polynesia?*

48. How is Europe bounded on the north? 49. How on the

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[a] See page 120 for the answer. See also page 166.
[b] See note, page 14. [c] See page 119.

south? 50. West? 51. East? 52. Give the boundaries of Asia, Africa, and America, in the same way. 53. Point out Australia, and the principal islands of Polynesia. 54. Which of the continents, or great divisions of land, are connected? 55. Are the oceans, or great divisions of water connected with each other? 56. The Pacific extends from? 57. The Atlantic extends from? 58. The Indian Ocean lies between? 59. The Arctic Ocean surrounds? 60. The Antarctic? 61. Are there, or could there be, any natural or definite boundaries between these oceans?

62. What is a *sea?* 63. Name and point out the seas connected with the Atlantic on the *east* side? 64. On the *west?* 65. The seas connected with the Indian and Arctic Oceans? 66. Why is there no part of the Antarctic Ocean called a sea? 67 Why was the Pacific so called?[a] 68. The *Atlantic* owes its name to? 69. The *Indian* Ocean, why so called? 70. The meaning of the terms *Arctic* and *Antarctic?*

71. Into how many grand declivities is Europe divided? 72. The *consequent* direction of the principal rivers in Europe? 73. Name some of them, and point to their sources and general direction.[b] 74. The great *physical* or natural divisions of Asia? 75. The great *northern* declivity lies between?[a] 76. By what great rivers may the northern declivity be traced?[b] 77. Name the other great natural divisions of Asia, and trace the principal rivers which flow through them.[b] 78. Into how many great natural divisions may South America be divided? 79. Into how many, North America? 80. Name and trace each upon the map.

81. The continents or great divisions of the land are subdivided into? 82. The *Political* divisions of the earth are? 83. Name, and trace upon the map, the countries in the *north* of Europe. 84. In the *north-east.* 85. In the *east?* 86. In the *middle?* 87. The *south* of Europe consists of three great projections, namely? 88. To the *west* of Europe is the *insular* kingdom of?

89. Name and trace upon the map, the principal *seas* of Europe. 90. Also, the *gulfs*, *bays*, *channels*, and *straits.* 91. Name, and point out the principal *islands* of Europe. 92. Also, the *peninsulas* and *capes.* 93. Where is the *Isthmus* of Corinth? 94. Of Perekop? 95. Name and trace upon the map the principal *mountain ranges* in Europe. 96. Also, the *rivers* and *lakes.* 97. The *empires* of Europe, and their capital cities?

98. The Five Great Powers of Europe? 99. The capital city of each? 100. The second-rate powers? 101. The capital city of

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[a] See note, page 167.

[b] For answers to these questions turn to pages 124 and 125.

each? 102. The third-rate powers, and the chief city of each? 103. What is the population of Russia?[a] 104. How much of the surface of Europe does Russia occupy? 105. How much is Russia larger than France? 106. The area of the British Islands? 107. Of the Caspian Sea?[b] 108. The meaning of the term *area?* 109. What is the difference between six square feet and six feet square? 110. Between sixty square miles and sixty miles square?

111. What is *latitude?* 112. *Parallels* of latitude? 113. Why so called? 114. In what direction, therefore, do they run? 115. The most important parallels of latitude are? 116. Why called *tropics?* 117. How many *zones* are there, and how is each bounded? 118. What is a *meridian?* 119. The first meridian? 120. What is longitude? 121. In what latitude is the entire northern hemisphere? 122. All Asia, Europe, and North America, are therefore in what latitude? 123. Over what countries and islands does the Equator pass? 124. How does it divide the Atlantic and Pacific Oceans? 125. Over what countries and islands do the Tropics pass? 126. Over what countries does the Arctic circle pass? 127. Through what straits in the western, and sea in the eastern hemisphere does it run?

128. Name all the countries in the Torrid zone. 129. Also, in the north and south Temperate zones. 130. Also, in the north Frigid zone. 131. In what zone is Europe? 132. What part of it lies within the north Frigid zone? 133. What part of the earth is the *warmest?* 134. Why the *middle?* 135. What parts of the Temperate zones, therefore, should we expect to find the *warmest?* 136. What the *coldest?* 137. What parts of the Temperate zones really deserve the name? 138. Why the *middle?* 139. What part of Europe, therefore, is the warmest? 140. Why the *south?* 141. Name all the countries in the south of Europe. 142. In what part of Europe is the temperature moderate? 143. Name all the *middle* countries of Europe. 144. Name the *cold* countries in Europe.

145. What are the principal productions of the *south* of Europe?[c] 146. Of the *middle* countries? 147. Of the *northern?* 148. What countries in Europe lie north of the parallel of 55°? 149. What countries are between the parallels of 55° and 45°? 150. What countries in Europe are south of the parallel of 45°?

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[a] See Table, page 178, for answers to these questions. In giving the answers, the nearest *round* number will be sufficiently accurate. Thus, to this question, the answer may be, "about 50 millions." To the next, "more than one-half, or nearly two-thirds."

[b] See Table, page 73, for the answer.

[c] For answers to these questions, see p. 153.

151. What parts of Asia and America are in the same latitude as the *southern* countries of Europe? 152. What, in the same as the *middle?* 153. What, in the same as the *northern?* 154. What part of America is in the same latitude as Ireland? 155. Which is the largest European island? 156. Asiatic? 157. African? 158. American? 159. Where is there no latitude? 160. Where no longitude? 161. At what point is there neither latitude nor longitude? 162. In what longitude is New Zealand?

163. Point to Cape Horn, Cape of Good Hope, Comorin, Romania, Severo or Taimura, Guardafui, Cape Verde. 164. The most northerly cape in Europe? 165. The most easterly cape in South America? 166. The most westerly in Africa? 167. Where is the White Sea? 168. The Black Sea? 169. The Red Sea? 170. The Yellow Sea? 171. What is an *Archipelago?* 172. Where is *the* Archipelago? 173. The Indian Archipelago? 174. The Columbian Archipelago?

175. One vessel meets another at 30° north latitude, and 60° west longitude; point to the spot. 176. A vessel springs a leak at 85° east longitude and 25° south latitude, show her position, and calculate how many miles she is from the nearest land.[a] 177. In a voyage from the Black to the White Sea, what straits, seas, &c., must be passed through? 178. From the Red to the Yellow Sea? 179. What is likely to be the cargo of a vessel from the Baltic? 180. Of one from the Mediterranean? 181. Of one from the West Indies? 182. Of one from India? 183. Of one from Greenland? 184. Of one from England?

185. Between what parallels does each of the continents lie? 186. Between what meridians? 187. The direction, and distance in degrees, of New Zealand from New Holland? 188. In what direction from New Holland is Polynesia? 189. What groups are in the same *latitude* as Madagascar? 190. What group in the same latitude as Mexico? 191. Name and trace on the map the discoveries of Captains Inglefield and M'Clure.

[Similar questions should be put to the pupils on the maps of Europe, Asia, Africa, America, &c. But, as in a MAP OF THE WORLD, the comparative size and relative position of all the divisions of the earth are presented to the pupils at one view, they should be kept at it till they become perfectly familiar with its great outlines. When once the image of a MAP OF THE WORLD is firmly fixed in the mind of a pupil, his difficulties in Geography are over.]

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[a] See p. 46 for the method.

POPULATION

OF THE CITIES AND TOWNS MENTIONED IN THIS WORK.[a]

Towns.	*Pop.*	*Page.*
Aalborg, . .	8,000	227
Aarau, . .	4,500	222
Aarhuus, . .	8,000	227
Aberdeen, . .	71,973	193
Abergavenny, .	5,025	182
Aberystwith, .	5,231	183
Abingdon, . .	5,945	183
Abo, . .	12,000	211
Acapulco, . .	4,000	246
Acre, . .	10,000	240
Aden, . .	25,000	239
Adrianople, .	100,000	236
Agra, . .	65,000	239
Agram, . .	17,000	213
Aix-la-Chapelle, .	46,000	216
Ajaccio, . .	11,500	206
Albany, . .	50,763	246
Albans, St., .	7,000	183
Aleppo, . .	60,000	239
Alessandria, .	36,000	221
Alexandria, .	60,000	243
Algiers, . .	95,000	243
Alicant, . .	25,000	218
Alkmaar, . .	9,500	228
Alloa, . .	6,676	191
Almeida, . .	6,000	220
Almeira, . .	19,000	218
Alnwick, . .	6,271	182
Alost, . .	15,000	230
Altorf, . .	1,700	222
Altona, . .	27,000	227
Amersfort, . .	9,000	228
Amiens, . .	47,000	207
Amoy, . .	200,000	239
Amsterdam, .	220,000	228
Amsterdam, New,	5,000	247
Ancona, . .	36,000	222
Andrews, St., .	5,107	191
Annan, . .	3,400	191
Annapolis, . .	3,000	246
Antioch, . .	10,000	240
Antrim, . .	2,500	195
Antwerp, . .	79,000	230
Appenzell, . .	5,000	222
Appleby, . .	2,519	182
Archangel, . .	24,500	210
Ardee, . .	3,000	195
Arequipa, . .	35,000	251
Argos, . .	5,000	234
Arlon, . .	5,000	230
Arklow, . .	3,306	195
Armagh, . .	9,500	196
Arnheim, . .	15,000	228
Asaph, St., . .	2,000	183
Ashbourne, . .	4,936	182
Assen, . .	2,500	228
Assumption, .	10,000	247
Astorga, . .	3,000	228
Astracan, . .	45,000	239
Athy, . . .	6,500	195
Athens, . .	27,000	235
Athlone, . .	6,500	195
Augsburg, . .	37,000	226
Augusta, . .	6,500	246
Augusta, . .	8,000	245
Augustine, St. .	2,500	246
Ava, . . .	30,000	238
Avila, . .	5,000	218
Axum, . .	4,000	243
Aylesbury, . .	6,000	183
Ayr, . . .	17,624	191
Badajoz, . .	13,000	219
Baden-Baden, .	6,000	225
Bagdad, . .	70,000	239
Bahia, . .	150,000	247
Bâle or Basle, .	25,000	223
Balbriggan, .	2,310	195
Balkh, . .	2,000	239
Ballina, . .	5,500	196
Ballinasloe, .	5,000	196

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[a] The population of the towns in Great Britain and Ireland is from the census of 1851. The population of the other towns is from the best and most recent authorities; but in many cases the numbers given should be regarded as mere estimates. This observation particularly applies to *Asiatic* and *African* towns.

Towns.	*Pop.*	*Page.*
Ballymote,	965	196
Ballyshannon,	3,700	195
Ballymena,	6,500	195
Baltimore,	169,054	246
Banagher,	1,846	195
Banbridge,	3,500	196
Banbury,	8,715	183
Bandon,	7,500	196
Banff,	6,000	191
Bangor,	6,388	188
Bangor,	2,850	196
Bangor,	14,432	245
Bankok,	50,000	239
Barcelona,	120,000	219
Bari,	19,000	221
Bassŏra,	60,000	239
Bastia,	13,000	206
Bath,	54,240	188
Beaumaris,	2,600	188
Bedford,	11,693	183
Belfast,	100,300	195
Belgrade,	30,000	236
Belize,	4,500	179
Belturbet,	2,054	196
Benares,	600,000	239
Benin,	15,000	243
Bergen,	25,000	232
Bergen-op-Zoom,	7,000	228
Berlin,	400,000	216
Berne,	25,000	223
Bervie,	864	191
Berwick,	15,094	182
Betlis,	10,000	239
Beyrout,	15,000	240
Biggleswade,	3,807	183
Bilbao,	15,000	218
Birr,	6,000	195
Birmingham,	232,841	187
Blackburn,	46,536	187
Bogota, S. F.,	40,000	247
Bois-le-Duc,	20,000	228
Bokhara,	150,000	239
Bologna,	75,000	222
Bolton,	61,171	187
Bo'ness,	2,600	191
Bombay,	300,000	233
Bonn,	15,500	217
Bordeaux,	120,000	206
rnou,	10,000	243
a-Serai,	60,000	236
Boston,	17,518	183
Boston,	136,871	245
Boulogne,	30,000	206
Boyle,	3,800	196
Boussa,	16,000	244
Braga,	15,000	220
Braganza,	4,000	220
Bray,	3,156	195
Brechin,	6,637	191
Brecknock or Brecon,	6,100	188
Breda,	13,000	228
Bremen,	75,000	225
Breslau,	112,000	216
Brest,	35,000	207
Bridgewater,	10,317	183
Bridgenorth,	7,610	182
Briel,	4,500	228
Brighton,	69,673	188
Brindisi,	6,000	221
Bristol,	137,328	187
Bruges,	44,000	230
Brunn,	45,000	213
Brunswick,	40,000	225
Brussels,	140,000	230
Bucharest,	80,000	236
Buckingham,	8,069	183
Buda or Ofen,	40,000	214
Buenos Ayres,	100,000	247
Burgos,	15,000	218
Bury St. Edmonds,	13,900	183
Cabes,	30,000	243
Cabul,	60,000	238
Cadiz,	55,000	219
Caen,	40,000	206
Caermarthen,	10,524	183
Caernarvon,	8,674	183
Caffa or Kaffa,	6,000	210
Cagliari,	30,000	221
Cairo,	250,000	243
Calcutta,	500,000	238
Callan,	3,500	195
Calmar,	6,000	231
Cambridge,	27,815	188
Campbelton,	6,880	228
Candahar,	50,000	238
Candy,	3,000	240
Canterbury,	18,398	188
Canton,	500,000	238
Cape Town,	22,500	243
Caraccas,	30,000	247

Towns.	*Pop.*	*Page.*
Cardiff,	18,351	183
Cardigan,	3,900	188
Carlingford,	887	195
Carlisle,	26,310	182
Carlow,	10,000	195
Carlscrona,	12,500	231
Carlsruhe,	24,000	226
Carrickfergus,	3,543	195
Carrick-on-Shannon,	1,796	196
Carrick-on-Suir,	6,500	196
Carrickmacross,	2,800	196
Carthagena,	36,000	219
Carthagena,	20,000	247
Cashel,	6,000	196
Cashgar,	18,000	240
Cassel,	33,000	225
Castlebar,	5,000	196
Castlebranco,	5,700	220
Castlecomer,	1,695	195
Castletown,	2,830	185
Catania,	54,000	221
Cavan,	3,700	196
Chamberry,	16,000	221
Chandernagore,	40,000	208
Charlemont,	530	196
Charleroi,	7,000	230
Charleston,	42,985	246
Chatham,	28,424	188
Chelmsford,	6,033	183
Cheltenham,	35,051	188
Chepstow,	4,300	182
Cherbourg,	23,000	206
Cherson,	24,000	210
Chester,	27,766	182
Chesterfield,	7,101	182
Chicago,	29,963	246
Chichester,	8,662	183
Christiania,	33,000	232
Christiansand,	8,000	232
Chuquisaca,	14,000	247
Cincinnati,	115,436	246
Cintra,	4,500	220
Clackmannan,	1,077	191
Clagenfurt,	15,000	213
Clausenburg,	22,000	213
Clones,	2,600	196
Clonmel,	16,000	196
Coblentz,	20,000	216
Coburg,	10,000	226
Coimbra,	15,000	220
Coire or Chur,	5,000	222
Colberg,	7,500	216
Colchester,	19,443	183
Coldstream,	12,200	191
Coleraine,	6,000	195
Cologne,	95,000	216
Colombo,	60,000	239
Columbia,	6,000	246
Columbus,	17,833	246
Concord,	8,000	245
Constantina,	30,000	243
Constantinople,	600,000	236
Cootehill,	2,500	196
Copenhagen,	130,000	227
Cordova,	57,000	218
Cordova,	15,000	247
Corfu,	20,000	235
Corinth,	2,000	234
Cork,	87,000	196
Corunna,	23,000	219
Courtray,	20,000	230
Coventry,	36,812	187
Cracow,	43,000	212
Cremona,	30,000	221
Cromarty,	2,000	190
Cronstadt,	45,000	210
Cullen,	1,700	191
Cumana,	10,000	247
Cupar,	5,686	191
Cuzco,	40,000	247
Dalkeith,	5,086	191
Damascus,	100,000	239
Dantzic,	66,000	216
Darmstadt,	27,000	225
Delft,	15,000	228
Delhi,	200,000	238
Denbigh,	5,498	183
Dendermonde,	9,000	230
Deptford,	23,165	188
Derby,	40,609	182
Detroit,	21,019	246
Deux Points,	7,000	258
Devonport	50,159	188
Deventer,	14,000	228
Devizes,	6,554	183
Diarbekir,	40,000	239
Dingle,	3,600	196
Dingwall,	1,966	190
Donaghadee,	2,818	196
Doncaster,	12,052	182

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Dongola, . .	6,000	243	Fahlun, ...	4,500	231
Dorchester, . .	6,394	183	Falkirk, . .	8,752	191
Dort, . . .	22,000	228	Falmouth, . .	5,000	187
Dornoch, . .	600	190	Faro, . .	8,000	220
Douglas, . .	8,647	185	Ferarra, . .	25,000	221
Dover, . .	22,242	183	Ferrol, . .	15,000	219
Dover, . .	6,458	245	Fez, . . .	80,000	243
Dover, . .	3,790	246	Flensborg, . .	15,000	227
Downpatrick, .	4,500	196	Flint, . .	3,300	183
Drammen, . .	8,000	232	Florence, . .	107,000	221
Dresden, . .	90,000	225	Flushing, . .	7,000	228
Drogheda, . .	17,500	195	Forfar, . .	9,311	191
Dromore, . .	1,872	196	Forres, . . .	3,500	191
Drontheim, .	14,000	232	Fortrose, . . .	1,148	190
Dublin, . .	258,361	198	Frankfort, . . .	70,000	225
Dudley, . .	87,962	182	Frankfort, . . .	26,000	216
Dumbarton, .	5,445	191	Fraserburg, . .	3,100	191
Dumblane, . .	1,911	191	Frauenfeld, . .	1,800	222
Dumfries, . .	13,166	191	Frederikshald, . .	5,000	233
Dunbar, . .	3,000	191	Frederikstad, . .	2,500	232
Dundalk, . . .	10,500	195	Fredericton, . . .	4,000	245
Dundee, . .	78,931	193	Freetown, . . .	13,000	243
Dunfermline, . .	13,836	191	Freyburg, . .	12,000	225
Dungannon, .	4,000	196	Friburg, . . .	8,000	222
Dungarvan, .	7,000	196	Gaeta, . . .	14,800	221
Dunkeld, . .	1,096	191	Galashiels, . . .	5,918	191
Dunkirk, . .	25,000	206	Galatz, . . .	20,000	236
Durazzo, . .	10,000	236	Gall. St. . . .	10,500	222
Durham, . .	13,188	182	Gallipoli, . .	17,000	236
Dusseldorf, . .	25,000	216	Galway, . .	22,000	196
Edenderry, . .	1,850	195	Gefle, . . .	8,000	231
Edinburgh, . .	160,302	193	Geneva, . .	30,000	222
Edgeworthstown,	817	195	Genoa, . .	115,000	222
Egripo, . .	5,000	234	Georgetown, .	25,000	247
Elbing, . .	20,000	216	Georgetown, .	8,000	246
Elgin, . .	6,337	191	Ghent, . .	95,000	230
Elsinore, . .	8,000	227	Gibraltar, . .	15,000	219
Elvas, . .	16,000	220	Gijon, . .	6,000	218
Ely, . . .	6,176	182	Girgenti, . .	18,000	221
Emden, . .	12,000	225	Glarus, . .	4,000	222
Ennis, . . .	9,000	196	Glasgow, . .	329,097	193
Enniskerry, .	380	195	Gloucester, .	17,572	188
Enniscorthy, .	6,500	195	Gluckstadt, .	6,000	227
Enniskillen, .	6,500	196	Goa, . . .	20,000	240
Erivan, . .	12,000	239	Gondar, . .	6,000	243
Erzeroum, . .	40,000	239	Gotha, . .	14,000	226
Esseck, . .	11,000	213	Gottenburg, .	30,000	231
Estella, . .	6,000	218	Gottingen, . .	11,000	226
Evora, . .	15,000	220	Granada, . .	70,000	219
Exeter, . .	40,688	187	Granard, . .	2,200	195

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Gratz,	50,000	213
Greenlaw,	1,355	191
Greenock,	36,689	191
Greenwich,	105,784	35
Groningen,	30,000	228
Guatemala,	50,000	246
Guildford,	6,740	183
Haarlem,	24,000	228
Haddington,	3,900	191
Hague,	60,000	228
Halifax,	26,000	245
Halifax,	33,582	184
Hall,	6,500	225
Halle,	25,000	216
Hamburg,	180,000	171
Hamilton,	9,630	191
Hanau,	15,000	225
Hanover,	28,000	225
Harrowgate,	3,372	188
Hartford,	13,555	245
Harwich,	3,829	183
Hasselt,	8,000	230
Hastings,	17,011	188
Havannah,	150,000	249
Haverfordwest,	6,580	183
Havre-de-Grace,	27,000	207
Hawick,	6,683	191
Hay,	1,455	183
Heidleberg,	13,500	226
Heilbronn,	10,000	225
Helvoetsluys,	1,644	228
Henly,	3,622	183
Herat,	50,000	238
Hereford,	12,113	182
Hernosand,	2,000	231
Hertford,	6,605	183
Hildesheim,	14,000	225
Hillsborough,	1,300	196
Hobart Town,	16,000	252
Holyhead,	5,622	188
Holywell,	5,740	183
Holywood,	1,408	196
Hoorn,	10,000	228
Huddersfield,	30,880	187
Hué,	100,000	238
Hull,	84,690	187
Huntingdon,	6,219	182
Hydra,	20,000	235
Innsbruck,	13,000	213
Inverary,	1,100	191
Inverness,	12,793	191
Ipswich,	32,914	183
Irkutsk,	18,000	239
Irvine,	7,500	191
Ispahan,	100,000	238
Ives, St.,	3,500	182
Jacca,	3,000	218
Jaffa,	4,000	239
Jago, St.,	65,000	247
Jago, St. de Com.,	28,000	218
Janina,	36,000	236
Jassy,	40,000	236
Jedburgh,	3,600	191
Jeddo,	1,000,000	239
Jena,	6,000	225
Jerusalem,	15,000	229
John, St., N. F.,	15,000	245
John, St., N. B.,	12,000	245
Kaffa,	7,000	210
Kelat,	12,000	239
Kells,	4,500	195
Kelso,	4,800	191
Kendal,	11,829	182
Kherson,	30,000	210
Khiva,	12,000	240
Kidderminster,	18,462	188
Kiel,	13,000	227
Kilbeggan,	1,442	195
Kildare,	1,298	195
Kilkenny,	18,000	195
Killala,	1,200	196
Killaloe,	2,230	196
Killarney,	7,000	196
Kilmarnock,	21,443	191
Kilrea,	993	195
Kilrush,	5,000	195
Kinghorn,	1,568	191
Kingscourt,	1,143	196
Kingston,	8,000	245
Kingston,	6,279	183
Kingstown,	10,453	195
Kingstown,	35,000	249
Kinross,	2,600	191
Kinsale,	6,000	196
Kirkcaldy,	10,475	191
Kirkcudbright,	2,700	191
Kirkwall,	3,500	190
Klagenfurt,	15,000	213
Knoxville,	2,000	246
Kokan,	50,000	24

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Kongsberg,	4,000	233
Konigsberg,	75,000	216
Lagos,	8,000	220
Lahore,	100,000	239
Lanark,	5,008	191
Lancaster,	16,168	182
La Paz,	30,000	247
Larissa,	30,000	236
Larne,	3,300	195
Lassa,	25,000	240
Lauenburg,	3,000	227
Launceston,	6,005	183
Lausanne,	15,000	223
Laybach,	13,000	213
Leamington,	15,692	188
Ledbury,	3,000	182
Leeds,	172,270	187
Leghorn,	80,000	222
Leicester,	60,584	187
Leighlinbridge,	1,292	195
Leipsic,	55,000	226
Leith,	30,919	193
Lemberg,	75,000	214
Leominster,	5,214	182
Leon,	6,000	218
Leon,	8,000	246
Lepanto,	2,500	234
Lerwick,	2,900	190
Letterkenny,	2,000	195
Leeuwarden,	21,000	228
Lewes,	9,533	183
Lexington,	8,000	246
Leyden,	37,000	228
Liege,	74,000	230
Lifford,	570	195
Lima,	55,000	247
Limavady,	3,300	195
Limerick,	55,000	196
Lincoln,	17,536	183
Linlithgow,	4,200	191
Linz,	35,000	213
Lisbon,	280,000	220
Lisburn,	6,700	195
Lisle or Lille,	68,000	206
Lismore,	2,800	196
Lichfield,	6,573	182
Little Rock,	4,000	246
Livadia,	6,000	234
Liverpool,	376,063	187
Llandaff,	570	183
Llanelly,	8,700	183
Loango,	15,000	243
Lodi,	16,000	221
LONDON,	2,362,236	187
Londonderry,	20,000	195
Longford,	5,000	195
Lorca,	40,000	218
Loretto,	8,000	221
L'Orient,	20,000	207
Loughborough,	10,900	182
Loughrea,	6,800	196
Louis, St.,	70,860	246
Louisville,	43,196	246
Louvain,	26,000	230
Lowell,	33,383	245
Lowestoft,	6,580	182
Lowtherstown,	1,100	196
Lubeck,	45,000	230
Lucca,	24,000	221
Lucerne,	10,000	223
Lucknow,	300,000	239
Ludlow,	5,376	182
Lugano,	4,500	222
Luneburg,	13,000	225
Lurgan,	4,500	196
Luxemburg,	12,000	228
Lynn Regis,	19,355	183
Lyons,	170,000	206
Macao,	30,000	239
Macclesfield,	39,048	187
Madras,	300,000	238
Madrid,	220,000	219
Maestricht,	22,000	228
Magdeburg,	55,000	216
Maidstone,	20,801	183
Malacca,	12,000	239
Malaga,	52,000	219
Mallow,	6,000	196
Malvern,	150	188
Manchester,	316,213	187
Manheim,	24,000	225
Manor Hamilton,	1,227	196
Mansfield,	10,012	188
Mantua,	28,000	222
Margate,	9,100	188
Marino, San,	5,000	221
Marlborough,	3,908	183
Marseilles,	150,000	207
Maryborough,	2,635	195
Massa,	8,000	221

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Matlock,	550	188	Nankin,	300,000	238
Matsmai,	50,000	239	Nantes,	87,000	206
Maynooth,	2,204	195	Naples,	340,000	221
Mecca,	30,000	238	Nauplia,	9,000	235
Mechlin,	24,500	230	Nashville,	10,478	246
Medina,	18,000	230	Natchez,	5,000	246
Meiningen,	6,000	224	Navan,	4,500	195
Melrose,	898	191	Navarino,	2,000	234
Memel,	10,000	216	Nenagh,	8,000	196
Mentz,	36,000	225	Neufchatel,	5,000	222
Mequinez,	60,000	243	Newark,	11,330	182
Messina,	85,000	221	Newark,	38,894	246
Mexico,	150,000	246	Newbern,	4,000	246
Miaco,	500,000	239	Newcastle,	3,000	196
Middleburg,	14,000	228	Newcastle-on-Tyne,	87,784	167
Milan,	180,000	214	N.C.-under-Line,	10,569	188
Milford,	2,800	183	New Galloway,	447	191
Miranda,	4,800	220	Newhaven,	20,345	245
Mistra,	1,500	235	Newmarket,	2,956	182
Moate,	1,979	195	New Orleans,	119,461	226
Mobile,	20,513	246	Newport,	9,000	245
Mocha,	7,000	238	New Radnor,	2,300	183
Modena,	27,000	222	New Ross,	7,700	195
Moffat,	1,413	191	Newry,	13,500	195
Mogadore,	17,000	243	Newtownlimavady,	3,300	195
Mold,	3,400	183	Newton,	6,371	183
Monaco,	1,200	221	Newtownards,	9,800	195
Monaghan,	3,800	196	New York,	515,507	246
Monmouth,	5,700	182	Nice,	35,000	221
Montgomery,	1,200	183	Nimeguen,	17,500	228
Mons,	23,000	230	Ningpo,	250,000	239
Monte Video,	12,000	247	Nismes,	45,000	207
Montpellier,	40,000	207	Norfolk,	14,000	246
Montreal,	44,000	245	Norrköping,	12,000	231
Montrose,	15,238	191	Northampton,	26,657	182
Morocco,	100,000	243	Norwich,	68,195	187
Moscow,	350,000	210	Nottingham,	57,407	188
Mostar,	7,500	236	Nuremberg,	40,000	226
Mosul,	40,000	239	Oakham,	2,800	182
Mountmellick,	4,000	195	Odensee,	9,000	227
Mountrath,	2,101	195	Odessa,	70,000	210
Mourzouk,	3,500	243	Okhotsk,	1,600	239
Mullingar,	5,500	195	Oldenburg,	8,000	225
Munich,	110,000	225	Omagh,	3,385	196
Munster,	24,000	216	Oporto,	80,000	220
Murcia,	36,000	219	Orleans,	40,000	207
Musselburgh,	7,092	191	Osnaburg,	12,000	225
Naas,	3,500	195	Ostend,	14,000	230
Nairn,	3,000	191	Otranto,	4,000	[illegible]
Namur,	21,500	230	Oudenarde,	5,000	[illegible]
Nancy,	33,000	206	Oviedo,	10,500	

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Oxford,	27,943	188	Presteign,	1,600	183
Padua,	50,000	222	Preston,	69,542	187
Paisley,	47,920	191	Providence,	41,512	245
Palermo,	180,000	221	Quebec,	40,000	245
Palma,	34,000	219	Queensferry,	1,233	191
Pampeluna,	14,000	218	Quito,	70,000	247
Panama,	10,000	250	Raleigh,	3,000	246
Paramaribo,	20,000	247	Ramsay,	2,104	185
Paris,	1,200,000	206	Ramsgate,	11,800	188
Parma,	36,000	221	Rangoon,	40,000	238
Parsonstown,	6,000	195	Rathkeale,	4,000	196
Passau,	10,500	225	Ratisbon,	25,000	226
Patras,	8,000	235	Ratzeburg,	2,000	227
Pavia,	24,000	221	Ravenna,	12,000	221
Peel,	2,133	185	Reading,	21,456	183
Pekin,	1,500,000	239	Reggio,	17,000	221
Pembroke,	10,107	188	Reggio,	18,000	221
Penrith,	6,668	182	Rendsburg,	10,000	227
Perth,	23,908	193	Renfrew,	3,000	191
Pesth,	65,000	214	Revel,	18,000	210
Perugia,	18,000	221	Rheims,	42,000	206
Peshawer,	50,000	239	Richmond,	27,482	246
Peterborough,	8,672	182	Riga,	71,000	210
Peterhead,	7,298	191	Rio Janeiro,	180,000	247
Petersburg,	500,000	210	Rochefort,	17,500	207
Pharsalia,	3,000	236	Rochester,	14,938	182
Philadelphia,	408,762	246	Rome,	170,000	221
Philippopoli,	30,000	236	Roeraas,	3,000	232
Philipstown,	748	195	Roscommon,	3,800	196
Piacenza,	30,000	221	Roscrea,	3,800	196
Pictou,	4,500	245	Rostock,	19,000	225
Pillau,	3,600	216	Rothesay,	7,104	191
Pisa,	20,000	221	Rotterdam,	90,000	228
Pittsburg,	46,601	246	Rouen,	91,000	206
Plymouth,	52,221	188	Ruthin,	3,400	183
Pondicherry,	40,000	239	Ryde,	7,147	188
Poole,	9,255	183	Sackatoo,	80,000	244
Portadown,	3,091	195	St. Gall,	11,000	222
Portarlington,	2,728	195	St. Ives,	9,872	182
Port-au-Prince,	15,000	249	St. Neots,	2,951	182
Port-Glasgow,	6,986	191	St. Salvador,	20,000	246
Portland,	20,815	245	St. Salvr. or Bahia,	150,000	247
Port-Mahon,	15,000	219	St. Salvador,	20,000	244
Portpatrick,	1,700	191	St. Sebastian,	9,700	218
Portsmouth,	72,096	188	Salamanca,	15,000	219
Portsmouth,	9,700	245	Salem,	20,264	245
Posen,	40,000	216	Salerno,	12,000	221
Potosi,	20,000	247	Salisbury,	11,657	183
Potsdam,	37,000	216	Salona,	2,500	234
Prague,	75,000	214	Saloniki,	70,000	236
esburg,	41,000	214	Salzburg,	12,000	214

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Samarcand,	10,000	239	Stamford,	8,933	183
San Marino,	7,500	221	Stanz,	5,000	222
San Juan,	30,000	249	Stavanger,	5,000	232
Sana,	40,000	239	Stettin,	42,000	216
Sandwich,	12,710	182	Stirling,	12,837	191
Santa Cruz,	5,000	247	Stockholm,	95,000	281
Santa Cruz,	9,000	219	Stockport,	53,835	182
Santa Fe,	4,000	247	Stockton,	9,808	182
Santander,	18,000	218	Stonehaven,	3,200	191
Santarem,	8,000	220	Strabane,	4,326	196
Santiago,	65,000	247	Stralsund,	17,000	216
Santiago,	28,000	218	Stranraer,	5,738	191
Saragossa,	40,000	219	Strasbourg,	62,000	207
Sassari,	22,500	221	Strelitz,	10,000	224
Savannah,	16,060	246	Stutgard,	38,000	225
Savona,	16,500	221	Sudbury,	6,043	183
Scarborough,	12,915	188	Suez,	20,000	244
Schaffhausen,	7,500	223	Sunderland,	67,394	187
Schemnitz,	20,000	214	Surat,	150,000	238
Schoumla,	20,000	236	Swansea,	31,461	183
Schweitz,	5,000	222	Sydney,	50,000	245
Schwerin,	13,000	225	Syracuse,	17,000	221
Scutari,	40,000	236	Tain,	2,000	190
Sebastian, St.,	10,000	218	Talavera,	8,000	218
Segovia,	13,000	218	Tangier,	10,000	243
Selkirk,	3,300	191	Taranto,	18,000	221
Semendria,	12,000	236	Tarragona,	11,000	218
Sennaar,	9,000	243	Taunton,	14,176	183
Serampore,	13,000	239	Tavira,	9,000	220
Seres,	25,000	236	Teheran,	60,000	238
Setuval,	15,000	220	Teruel,	8,000	218
Sevastopol,	30,000	211	Thebes,	3,000	234
Seville,	91,000	219	Thorn,	10,000	212
Sheffield,	135,310	187	Thurles,	6,500	196
Shiraz,	20,000	238	Thurso,	2,510	190
Shrewsbury,	19,681	182	Tiflis,	50,000	240
Sidon or Saide,	6,000	240	Tipperary,	7,500	196
Sienna,	19,000	221	Tirlemont,	8,000	230
Singapore,	16,000	179	Tivoli,	6,000	221
Sion or Sitten,	2,500	223	Tobolsk,	15,000	239
Sleswig,	11,000	227	Tokay,	5,700	214
Sligo,	12,000	196	Toledo,	15,000	219
Smyrna,	150,000	239	Tongres,	5,000	230
Soleure,	5,000	222	Tornea,	700	234
Sophia,	46,000	236	Toronto,	30,000	245
Southampton,	35,305	187	Tortosa,	16,000	218
Southwark,	172,863	183	Toulon,	45,000	207
Spa,	4,000	230	Toulouse,	83,000	206
Spanish Town,	6,000	249	Tours,	27,000	207
Spire,	9,000	225	Tournay,	33,000	230
Stafford,	11,829	182	Tralee,	11,000	196

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Tranquebar,	12,000	238
Trawnik,	8,000	236
Trebizond,	30,000	239
Trent,	13,000	214
Trenton,	6,000	246
Trieste,	50,000	214
Trim,	2,000	195
Tripoli,	15,000	240
Tripoli,	20,000	243
Tremsoe,	1,500	232
Tron, St.,	9,000	230
Troppau,	12,500	213
Truro,	10,733	183
Truxillo,	4,000	247
Truxillo (Peru),	6,000	247
Tuam,	5,500	196
Tudela,	8,000	218
Tullamore,	5,800	195
Tunis,	100,000	243
Turin,	120,000	221
Tyre,	5,000	249
Ulm,	14,000	226
Umea,	1,500	231
Uppingham,	2,100	182
Upsal,	5,000	231
Utrecht,	50,000	228
Uxbridge,	3,200	183
Valencia,	66,000	219
Valetta,	50,000	222
Valladolid,	25,000	218
Valparaiso,	30,000	247
Van,	20,000	239
Vandalia,	1,000	246
Varna,	16,000	236
Venice,	114,000	214
Vera Cruz,	10,000	246
Verona,	47,000	222
Verviers,	27,000	230
Viana,	8,000	220
Viborg,	3,500	227
Vincennes,	3,500	246
Vicenza,	31,000	221
Vienna,	410,000	214
Vigo,	6,000	218
Villa Real,	8,000	220
Vimieiro,	1,800	220
Vittoria,	12,000	218
Wakefield,	22,057	187
Ware,	4,900	183
Warsaw,	154,000	212
Warwick,	10,973	182
Washington,	40,001	246
Waterford,	24,000	196
Waterloo,	1,900	230
Weimar,	13,000	226
Welshpool,	4,400	183
Westport,	5,500	196
Wexford,	12,500	195
Weymouth,	9,458	183
Whitehaven,	18,916	182
Wick,	6,772	190
Wicklow,	3,141	195
Wiesbaden,	10,000	225
Wigton,	2,100	191
Wilmington,	13,900	246
Winchester,	13,704	183
Windsor,	9,596	183
Wolfenbuttel,	10,000	225
Wolverhampton,	50,000	182
Woodstock,	7,983	183
Woolwich,	32,367	188
Worcester,	27,528	188
Worms,	8,000	225
Wrexham,	6,714	188
Wycombe,	7,179	188
Xeres,	34,000	218
Yarkand,	50,000	240
Yarmouth,	30,879	187
York,	40,359	188
Youghall,	8,000	196
Ypres,	15,000	230
Zara,	6,800	213
Zell,	10,000	225
Zug,	3,000	222
Zurich,	17,000	223
Zutphen,	10,000	228
Zwoll,	15,000	228

GEOGRAPHICAL PRONOUNCING VOCABULARY.

DISCREPANCIES in the pronunciation of geographical names are sources of difficulty not only to pupils but to teachers. Nor is this surprising: in our own language there are many words of difficult and disputed pronunciation; we should not expect, therefore, any thing like uniformity in the pronunciation of the names of foreign countries and places.

It is obvious that no general rules can be given for the pronunciation of foreign words. The following observations will, however, be found of use to the learner.

VOWELS AND DIPHTHONGS.

1. A.—In French, Italian, Spanish, and Portuguese words *a* has the sound of *ah* in English. In the German languages it has two sounds, a long and a short: the first is sounded like *a* in our word *half*, and the second has no corresponding sound in English.

2. AE *or* Ä.—In *German* words *ae* or *ä* has two sounds, a long and a short: the former is like the sound between *name* and *care*, and the short, nearly like *e* in *rent*.

3. AI *or* AY.—In *French* words *ai* has, generally speaking, the sound of *e*, as in our word *there*. In the *German* languages *ai* or *ay* sounds broader than the English *i* in *kite;* or as we pronounce *ai* in *aisle*.

4. AU *or* EAU.—In *French* words *au* and *eau* are pronounced like our long ō. Thus Hainault is pronounced *Hainō;* and Bordeaux, *Bordō*. In the *German* languages *au* approaches the sound of *ou* in our word *our*. Thus Breslau is pronounced *Breslou;* and Pillau, *Pillou*.

5. AEU *or* ÄU.—In *German* words *aeu* or *äu* has nearly the same sound as the diphthong *oi* in our word *toil*. Compare the German sound of *eu*.

6. E.—In *French* words é with the acute accent is sounded like our long *a*, as in *fate;* è with the grave, and ê with the circumflex accent, like *e* in *there;* and *e* not accented is generally pronounced like our *open e*, as in *met*. In *Italian* words *e* has either an open sound like *ai* in *fair*, or a close sound like the same diphthong in *pain*.

7. In *Italian* words *e final* is pronounced; but in *French* it is mute, unless marked with the acute accent (*é*).

8. EI.—In *French* words *ei* has the sound of *e*, as in our word *there*. In *German* words *ei* or *ey* has the sound of our long ī, as in *fine*.

9. EU, ÊU, ÉU.—In *German* words *eu* sounds like *oi* in our words *toil* and *joint*. Compare the sound of *aeu* or *äu* in the same language.

For the *ēu* or *ĕu* in French words, we have no corresponding sound, but it is something like the sound of *e* in *her*; or *u* in *fur*.

10. I.—In French, Italian, and most foreign words *i* has the sound of *ee* in English. But in some *French* and *German* words *i* has a short sound, as in our word *fig*.

11. IE *or* I.—In German words *ie* or *ï* has the sound of our long *e* or *ee*, as in *me* or *meet*.

12. O.—In most foreign languages *o* has, generally speaking, either a long sound, as in our word *robe*; or a short sound, as in *rob*.

13. OE *or* Ö.—In *German* words *oe* or *ö* has a long sound like the French *ēu*; or a short sound like the French *ĕu*.

14. OI.—In *French* words *oi* is sounded like the syllable *wa*, in our word *water*.

15. OU.—In French and foreign words *ou*, generally speaking, is sounded like *oo* in English, as in *fool*.

16. U.—In most foreign words *u* has a sound intermediate between the sounds of *oo* and *eu* French. Before *a*, *u* is often pronounced like *w*, as in *Guayaquil* (*Gwa-a-keel*). Compare the pronunciation of *u* before *a* in our words *assuage*, *equal*, *persuade*, *language*.

17. UE *or* Ü.—In German words *ue* or *ü* has the foreign sound of *u*.

18. UI.—In *German*, and in some other words, *ui* has the sound of *ooe* or *we*.

19. W.—In *Welch* words *w* has the sound of *oo* in English. Thus, Amlwch is pronounced *Amlootch*.

CONSONANTS.

20. CH.—Except in *French* and *Spanish* words, *ch* is usually pronounced like *k*; as in Muni*ch*, Zuri*ch*, *Ch*erson, Mo*ch*a, *Ch*imborazo, &c. But in *French* words *ch* is pronounced like *sh*; as in *Ch*ampagne, *Ch*erbourg, *Ch*alons, &c.; and in *Spanish* words *ch* is pronounced like *ch* in our word *church*.

21. C, CC, CH.—In *Italian* words *c* before *e* or *i* is pronounced like *ch* in our words *cherry* and *chilly*; *cc* before *e* or *i*, like *tch* in our word *match*; but *ch* is pronounced like *k* in English; as in Civita Vecchia (*cheeveeta vekia*).

22. GN.—In *French* and *Italian* words *gn* is pronounced something like *ni* in our words *onion*, *minion*. In *Spanish* *ñ* has a similar sound; and so, also, *nh* in *Portuguese*.

23. GH, GLI.—In Italian words *gh* has the hard sound of *g*, as in *go*; and *gli* has the liquid sound of *lli*, as in *million*, *seraglio*.

24. SCH.—In *German* words *sch* is, generally speaking, pronounced like *sh*. In Italian words *sch* is pronounced *sk*.

25. V, F, W.—In *German* words *v* is pronounced like *f*; and *w*, like *v*. But the *w* in final *ow* is always silent.

26. S, T, D, X.—In *French* words the consonants *s*, *t*, *d*, *x*, are not pronounced when ending a word. But *Paris*, *Brest*, *Rheims*, *Arras*, and a few others are pronounced by us as if they were English words.

27. Z, *or* ZZ.—In *Italian* words *z* or *zz* is pronounced like *ts* or *ds*.

28. In the names of places in India, and in the East generally, the accent is usually on the last syllable; as in Hindostan', Affghanistan', Hyderabad', Seringapatam', Serampore', Ispahan', Teheran'.

29. When the learner is in doubt about the pronunciation of a foreign word, the best way is to pronounce it as if it were English.[1]

30. As in the following list of words the letters have the usual English sounds, their pronunciation may be acquired by attending to the *accent*, and by keeping in mind that the letters in *Italic* are silent or not pronounced; and that this mark (—) denotes a long, and this (⌣) a short sound or syllable. Also, that *c* with a *cedilla* under it (thus *ç*) is pronounced like *s*, as in *Iviça*.

The figures after the words refer to the preceding rules.

Abbeville, ab-veel.[10]
Abbeyleix, (-leese.)
Abergavenny, ab-er-gain′-y.
Achil, ak′-il.
Af-ghan-i-stan′.[28]
Ag′gerhuus, (-hoos).
Aghadoe, ah-ă-doo′-e.
Agulhas, a-gool′-yas.
Ais*ne*, ain.
Aix-la-Chapelle, aiks-la-shapel′.
Ajacció, a-yatch′-i-o.
Albuera, ăl-boo-e′-ra.
Alemtejo, (-tay′-zho).
Alencon, ă-lang-song.
Al-giers, ăl-jeers′.
Al-go′-a Bay.
Al′-i-cant.
Al-la-ha-bad′.[28]
Al′-le-g*h*a-ny.[30]
Al′-lŏ-a.
A*l*n*w*ick, an′-ick.[30]
Alsace, al-sas′.
Al-tŏ-na.
Amlwch, am′-lootch.[19]
An-co′-na.
An-da-lu′-si-a (shee-ă).[10]
An-dă-man.
An′-do-ver.
An-go′-la.
An-go′-ra.
Angouleme, awn-goo-laim′.
Anjou, awn-zhoo′.
An-nap′-ŏ-lis.
Anspac*h*, ans′-spak.[30]
Antigua, an-tee′-ga.[16]
Antilles, an-teel′.
An-tip′-a-ros.
A-ra-can′.
Ar′-ă-rat.
Archangel (ark-).
Ar-chi-pel′-a-go (ark-).
Arequipa, ar-e-kee′-pa.[10]
Ar-gyll′, ar-guile.
Ar-kan′-sas, or Ar′-kan-saw.
Ar-ma*g*h, ar-mah′.[30]
Arnheim, arn′-hime.[8]
Ar′-ră-gon.
Ar′-ras.
Artois, art-waw′.[14]
Ar′-ŭndel.
Ash-an-te′e.
As-phal-ti′-tes.
As-tră-bad′.[26]
As-tră-can′.
Athy, athī′.
Aubigny, o-been-yee.[22]
Auch, osh.
Augsburgh, ouks′-boorg.
Aurillac, o-reel′-yac.
Auvergne, o-vairn′.
Auxerre, o-zair′.
Avignon, a-veen-yong′.[28]
Avranches, av-ransh′.
Aylesbury, ailz′-ber-ry.
Azores, a-zo′rs.
Azov, a-zov′.
Badajos, bad-a-hos′.
Ba-ha′-mas.
Ba-hi′-a, ba-hee′-a.[10]
Baikal, bī′-kal.

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[1] In English words the tendency of the *accent* is to the *root*, and not to the termination. Hence, as a general rule, the accent on English words is usually on the first syllable; but the exceptions are numerous. See "Principles of Pronunciation" in the Introduction to the Author's English Dictionary.

Balize, ba-leez′.
Balk*h*, balk.
Ballina, ba-li-na′.
Baltic, bawl′-tik.
Banagher, ban′-ă-her.
Bar-ba′-does.
Bar-bu′-da.
Basle, bahl.
Bas-so′-ra.
Bayonne, bah-yōne.
Beaumaris, bo-may′-ris.
Beauvais, bo-vay′.
Beira, be-ee′ra.
Benares, ben-airz′.
Ben-coo′-len.
Be-nin′.
Berbice, ber-bee′ce.
Ber-mu′-das.
Berwick, ber′-rick.
Besançon, be-zan′-song.
Bil-bo′-a.
Blois, bloaw.
Bois-le-Duc, boaw-le-dook.
Bojador, bo-ya-dor′.
Bok-ha′-ra.
Bologna, bo-lo′-nya.
Bolognese, bo-lōn-ye′se.
Bo-ni-fa′-ci-o (-chee-o).
Boötes, bo-o′-tes.
Bordeaux, bur-do′.
Bornou, bor-noo′.
Bos′-phŏr-us.
Bouillon, boo-eel-yong.
Boulogne, boo-lōanye.
Bourbonnois, boor-bon′-ay.
Bourges, boorzh.
Brabant′.
Brahmaputra (-poo′-tra).
Brazil, bra-zeel′.
Breslau, bres′-lou.⁴
Bretagne, bre-tang′.
Bruges, broozh.
Bucharest, boo′-kar-est.
Bu′-e-nos Ay-res(boo-).
Bury St. Edmonds (berry).
Cabul, ca-bool′.
Caen, kawng.
Ca*e*r-mar-then (car-).
Ca*e*r-nar′-von (car-).
Cagliari, kal′-ya-ree.
o, ki′-rō.

Ca-la-bar′.
Cal*a*is, cal′-lis, or kal-lay′.
Cal-la′-o.
Can-da-har′.
Cannes, kānn.
Can-o′-pus.
Canterbury (-berry).
Can-ton′.
Cantyre, kan-tíre.
Cape Breton′.
Ca-rac′-cas.
Carlsruhe, carls-roo′-hay.
Car-tha-ge′-na.
Castile, cas-teel′.
Cau′-că-sus.
Cay-en′ne.
Cel′-ĕ-bes.
Cerigo, che-ree′-go.
Cevennes, say-ven′.
Ceylon, sai-lon′.
Chalons, sha′-long.
Chamberry, sham-ber′-ry.
Chamouni, sha-moo′-ny.
Champagne, sham-pang′.
Champlain, sham-plain′.
Charleroi, sharl-rwa′.
Chatham, chat′-am.
Chelmsford, chemz′-furd.
Cheltenham, chelt′-nam.
Cherbourg, sher′-boorg.
Cherson, ker′-son.
Cheviot, cheev′-yot.
Chiavara, ki-a-var′-e.
Chi-a-ven′-na (kee-).
Chicago, she-kaw′-go.
Chili, chee′-lee.
Chim-bo-raz′-o (*ch* hard).
Chiusa, ki-oo′-sa.
Chuquisaca, choo-kee-sa′-ka.
Chusan, choo′-san.
Cirencester, sis′-e-ter.
Civita Vecchia, chee′-veeta vek′-ia.
Cognac, cōne-yàck.
Coimbra, ko-eem′-bra.
Cologne, cō-lōanye.
Com′-ŏ-rin.
Co-mōr′-ro.
Coquet, cok′-et.
Cordilleras (-ye′-ras).
Cor′-do-va.
Co-re′-a.

Corfu, kor-foo'.
Cowes, kowz.
Cra'-cow.
Cre-mo'-na.
Crim-e'-a.
Croix, St. (croaw).
Crom'-ăr-ty.
Cuença, koo-en'-sa.
Cul-lo'-den.
Curaçoa, coo-ra-so'.
Curische-haff, koor-ish-haf.[a]
Da-'rĭ-en.
Dauphine, do-fee-nay.
De-can'.
De-la-go'-a Bay.
Delhi, del-hee.
Denbigh, den'-by.
De*p*tford, det'-ford.
Detroit, de-traw'.
Deux Ponts, deu-pong.
Di-ar-be'-kir.
Dieppe, dee-ep'.
Dijon, dee-zhong.
Dnieper, nee-per.
Dniester, nees'ter.
Douay, doo'-ay.
Doura, doora.
Drenthe, dren'te.
Drogheda, draw'-e-da.
Droitwich, droit'-ich.
Drontheim, dront'hime.
Durazzo, door-at'-zo.
Ecuador, ek-wah-do're.
El'-gin (*g* hard).
Esquimaux, es-ke-mo'.
Es-se-qui'-bo (-kee-).
Es-tre-ma-du'ra (-doo-ra).
Eu-phra'-tes.
Evesham, ee'-sham.
Eyder, ee'-der.
Falmouth, fal'-muth.[b]
Fermanagh, fer-man'-a.
Fer-rol'.
Foix, fwa.
Fontainebleau, fōn-tain-blo'.
Frieschehaff, freesh'-haf.
Friule, free-oo'-le.
Funchal, foon'-shål.
Gaeta, ga-e'-ta.
Ga-la-pa'gos.
Gal-lip'-ŏ-li.
Ga-ron'ne.
Genoa, jen'-ŏ-a.
Ghent, ghent or gwang.
Glasgow, glas'-go.
Gloucester, glos-ter.
Gotha, go'-ta.
Gra-na'-da.
Green-*w*ich.[c]
Gron'-in-gen.
G*u*adaloupe, gad-a-loop'.
Guardafui, gar-da'-fwee.
Guatemala, gwȧ-tee-ma'-la.
Guayaquil, gwa-a-keel'.
Guernsey, gern'-zy.
Ha*e*rlem, har'-lem.
Hague, haig.
Hainault, hay-no'.
Haiti, hay-tee.
Han'-ŏ-ver.
Har-*w*ich.
Ha-van'-nah.
Ha*v*erfordwest (har'-fŭrd-).
Havre-de-grace (-gras').
Heb'-ri-des.
He-le'-na.
Hel-i-gŏ-land'.
Helvoetsluys, hel'-vet-slooz.
He-rat'.
Herault, he-ro'.
Her-cu-la'-ne-um.
Hesse-Cas'-sel (hess-).
Hin-do-stan'.
His-pan-i-o'-la.
Holstein, hol-stin'.
Hon-du-ras (doo'-ras).
Hue, hu-ĕ.
Hu-ron'.

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[a] Curische-haff, that is, the *haven of Courland*.

[b] The termination *mouth* in English towns is pronounced *muth*; as in Ply*mouth*, Ports*mouth*, &c.

[c] In the termination *wick* and *wich* in English, the *w* is silent, as in War*w*ick, Green*w*ich, &c.

Hy-dra-bad'.
I'-co*l*m-kili.
Illinois, eel-e-nois'.
In-ver-a'-ry.
Ips-*w*ich.
Irak-Arabi.
Irkutsk, ir-kootsk.
Is-pa-han'.
Ja'-va.
Jedburgh, jed'-burro.
Kamts-chat'-ka (-kat-).
Kes'-*w*ick.
Kil-la-loe (-loo').
Lab-ra-dor'.
La-do'-ga.
La-hore'.
Lan-ark'.
Launceston, lanston.
Lausanne, lo-zann'.
Layba*ch*, lay'-bac.
Leghorn, leg'-orn.
Leicester, les'-ter.
Leinster, lin'-ster.
Leipsic, līpe-sig.
Leitrim, lee'-trim.
Leominster, lems-ter.
Ler'-*w*ick.
Le-vant'.
Liege, lee-aije.
Lima, lee'-ma.
Limoges, lee-mozh.
Lincoln, lin'-cun.
Lisle, leel.
Lo-an'go.
Loff-o'-den.
Loire, lwar.
Loo-choo, or Leoo Keoo.
L'Orient, lo'ri-awng.
Louvain, loo-vain'.
Lu-cay'-a.
Lucca, look'-ka.
Lyons, lee-ong' or ly'-ons.
Lyonnois, lee-on-nay'.
Ma-ca'-o, or ma-kou'.
Ma-dras'.
Ma-drid'.
Maestricht, maze'-trikt.
Mag-da-le'*n*a.
Mag'-de-burg.
Ma*gg*iore, mad-jee-o'-re.
Mal-a-bar'.
Ma-lac'ca.
Mal'-a-ga.
Malines, maleen.
Manheim, man'-hime.
Ma-ra-cay'-bo.
Mar-ga-ri'-ta (-ree-ta).
Marino, ma-ree'-no.
Mar'-mŏ-ra.
Marquesas, mar-kee'-sas.
Marseilles, mar-sailz'.
Martinico, mar-ti-nee'-co.
Mar'-y-bo-rou*gh*.
Massa-chus'-etts (-tshoo-setts)
Mat'a-pan.
Meaux, mo.
Medina, me-dee'-na.
Messina, me-see'-na.
Me*t*z.
Mi-a'-co.
Michigan, mish'-ĭ-gan.
Mil'-an.
Min-da-na'-o.
Mir-a-mi-chi' (-shee).
Missouri, mis-soo'-re.
Mobile, mo-beel'.
Mocha, mo'-ka.
Mod'-ĕ-na.
Mo'-ga-dore.
Mont Blanc, mong-blawng'.
Mon-te'-go Bay.
Montpelier, mong-pel-yay'.
Montreal, mont-re-äl'.
Mont-ser-rat'.
Mo-re'-a.
Morecambe Bay, more'-cam.
Mor-oc'-co.
Mourzook, moor-zook'.
Mo-zam-bique (-bee'k).
Munich, mu'nik.
Naas, nais.
Namur, na-moor'.
Nan-kin'.
Nantes, nawngt.
Nap'-ŏ-li di Romania.
Nar-bo'n*n*e.
Na-va-ri'-no (-ree'-no).
Navarre, na-var'.
Neagh, na'ay.
Niacaragua, nee-kar-a-gooa.
Neufchatel, noo'-shat-tel'.
Ni-ag'-a-ra.

Nice, nees.
Nic-o-bar′.
Nieman, nee'man.
Niger, ni'jer.
Nimeguen (*g* hard).
Nismes, neem.
Nordhausen, nort-hou′-zen.[4]
Nor-*w*ich.
Nov′-go-rod.
O′-ă-sis.
O-ce-an′i-ca.
O-den-see′.
O-des′-sa.
Œesel, o′-sell.
O-hi′-o.
Oleron, o-ler-ong′.
O′-ma*g*h.
Omer, St., sawngt o′mair.
O-ne′-ga.
Or-i-no′-co.
Orleans, or-leang′ or or′-lee-ans′.
Otaheite, o-ta-heet′.
Oude, ood.
Oudenarde, ood-nard.
Ouse, ooz.
Overyssel, ō-ver-ī′-sel.
O-vi-e′-do.
O-why-hee′.
Pal-my′-ra.
Pam-pe-lu′-na (-loo-na).
Pan-a-ma′ (mah).
Paraguay, (-gway or goo-e).
Pa-ra-ma′-ri-bo.
Pays de Vaud, pay′-ee-de-vo.
Pe-kin′.
Pen-sa-co′-la.
Perpignan, per-peen′-yang.
Piacenza, pee-a-chen′-za.
Pictou, pic-too′.
Piedmont, pee-e-mōng.
Pillau, pil-lou′.[4]
Pisa, pee′-sa.
Poictiers, pwa-teers.
Poitou, pwa-too′.
Pon-di-cher-ry (sher-ry).
Port-au-Prince, port-o-prawngse.
Port Mahon′.
Porto Rico (ree′-co).
Po-to′-mac.
Po-to′-si.
Presteign, pres′-teen.
Province, pro-vawngse.
Puerto, pwer′-to.
Pu′-lo Pe′nang.
Puy-de-Dome (pu′-ee).
Pwllheli, pool-he′-li.[19]
Pyr′-e-nees.
Quebec, kway-bek′.
Quito, kee′-to.
Ragusa, ra-goo′-sa.
Raleigh, ra′-ly.
Raphoe, ra-fo′.
Reading, red′-ding.
Reggio, red′-jo.
Rennes, ren.
Rheims, reemz.
Rio Janeiro, ree′-o ja-nee′-ro.
Rochelle, ro-shel′.
Romagna, ro-man′-ya.[22]
Rouen, roo-awng′.
Rousillon, roo-seel′-yong.
Rovigno, ro-veen′-yo.[22]
Ru′-gen (*g* hard).
Sack-a-too′.
Sag-ha′-li-en.
Sa′-*h*ă-ra.
Sarawak, sar-aw′-wak.
St. Cloud, sawngt cloo.
St. Croix (cro-aw′).
St. Jago, (i-a′go).
St. Roque (rōke).
Salisbury, solz-berry.
Sal-o-ni′-ca.
Sal-va-dor′.
Sa-mar-cand′.
Sand′-*w*ich.
Santa-Fe′ (-fay).
Santa-Fe de Bo-go′-ta.
San-ti-a-′go.
Saône, sōne.
Scafell, skaw′-fell.
Schaffhausen, shaf-how′-sen.
Scheldt, skelt or sheldt.
Schelling, shel′-ling.
Schiedam, skee′-dam.
Schumla, shoom′-la.
Schleswig, shles′-vig.
Schuylkill, skool′-kill.
Schwartzwald, shvarts′-valt.
Schwerin, shwe′-rin.
Scio, shee′-o.
Scutari, skoo-tar′-i.

Seine, sayne.
Sen'-e-gal.
Sen-na'-ar.
Ser-in'-ga-pa-tam'.
Set-u-val' or St. Ubes.
Se-vill'e.
Sevres, sa'vr.
Seychelles, say-shell'.
Shrewsburry, shroz'-berry.
Siam, se-am'.
Si-am'-pa.
Si-er'-ra Le-o'-ne.
Si-er'-ra Mo-re'-na.
Sin-ga-po're.
So-co'-tra.
So-fa'-la.
Southwark, suth'-ark.
Squillace, squil-la'-che.
Stamboul, stam-bool.
Stock'-holm.
Stranraer, stran-rar'.
Strom-bo'-li.
Suez, soo'ez.
Su-ma'-tra.
Su-rat'.
Tahiti, tah-hee'-tee.
Ta-la-ve'-ra.
Tangier, tan-jeer'.
Ta-ren'-to.
Taumton, tan'-ton.
Tau'-rĭ-da.
Tavira, tah-vee'-ra.
Te-he-ran'.[28]
Ten'-e-riff (reef).[10]
Ter-cei'ra, ter-see'-ra.
Ter'-ra del Fu'-e-go.
Tewkesbury (-berry).
Thames, temz.
Theiss, tice.
Ticino, tee-chee'-no.
Ti-ti-ca'-ca.
Tiv'-ŏ-li.
To-ba'-go.
To-kay'.
To-le'-do.
Ton'-ga-ta-boo'.
Tonquin, ton-keen'.
Tor'-nè-a.
Tor-to'-la.
Toulon, too-lon'.
Toulouse, too-looz'.
Tours, toor.
Tra-fal'-gar.
Tran-que-bar'.
Tre-vi'-so, tre-vee'-so.
Trieste, tree-est'.
Trin'-com-ă-lee'.
Tri-ni-dad'.
Trip'-ŏ-li.
Tri-po-liz-za (lit'-za).
Troyes, troaw.
Turin, too'-reen.
Ty-rol'.
Uist, wist.
Ulea, oo'-le-a.
Ural, oo'-ral.
Utrecht, u'-trekt.
Vera Cruz (crooce).
Valais, valay.
Val-la-do-lid'.
Val-pa-rai'-so.
Vaud, vo.
Vendee, vawng'-day.
Venezuela (zoo-e'-la).
Vosges, vozh.
Wald, valt.
Wardhuus, ward-hoos.
Warwick, war'-ik.
Widdin, vid'-din.
Wittenburgh, vit'-ten-boorg.
Wiesbaden, vees-bad'-en.
Yar-kand'.
Yar'-mouth, yar'-muth.
Yenikale, yen'e-kal'-e.
Yeovil, yo'-vil.
Youghal, yaw'-hăl.
Ypres, ee'-p'r.
Yu-ca-tan'.
Zurich, zu'-rik.
Zuider Zee, zoi'-der-ze.

APPENDIX.

INTRODUCTION TO GEOLOGY.

To a complete knowledge of Geography, some acquaintance with the science of *Geology* is necessary. We shall, therefore, in addition to what has been said on this subject in the chapter on *Mountains* (page 60), give a short sketch of its leading principles.

GEOLOGY is that science which treats of the internal *structure* of the earth, and of the various *materials* of which it is composed. But how, it may be asked, can we know anything of the internal structure of the earth? It is, as we have seen, an opaque and solid globe; and from the surface of it on which we stand, to the centre, is nearly 4,000 miles. Compared with this distance, the deepest excavations we can make in it are mere scrapings at the surface.[a]

But even if we could penetrate to the centre, and make ourselves acquainted with the nature and arrangement of all the materials in that particular direction, it is obvious, that from such a result, no general conclusions could be drawn. Such must be our first thoughts on the subject, and such were the opinions, even of learned men, till Geology began to be studied as a science.

EARTHS.

At first view, the materials at or near the surface of the earth seem to be without arrangement or design; but on examination, we shall find that this is not the case. On, and immediately below the surface, will be found, generally speaking, loose or unconsolidated materials, which are called EARTHS; and from a due admixture of those earths is formed the SOIL of our gardens and our fields. The first in order is called *vegetable mould*, because it is composed principally of decayed vegetable and animal substances; and it is obvious that if this material had not been deposited at the surface of the earth, there could have been no vegetation, and consequently no support for animal life. The other earths are principally composed of particles which have been *disintegrated*[a] or worn away from the various rocks which form the crust of the earth; and hence they have been called *mineral* earths. The *disintegration*, or crumbling away of solid rocks is occasioned by their long exposure to the influence of the atmosphere,[b] and to the continued action of the rain and the winds. Each of these earths is distinguished by the name of the mineral which enters most largely into its composition; and each of them is found to be subservient to the wants and convenience of man.[c]

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[a] The depth of the deepest mine yet made is less than half a mile, that is, less than the *eight-thousandth* part of the distance from the surface to the centre of the earth.

Thus, when earths are composed principally of SILEX or *flint*, they are called *Siliceous;* when of CALX or *limestone, Calcareous;* and when of ARGILLA or *clay, Argillaceous*. The term *alumina* is sometimes used instead of *argilla*.

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[a] *Disintegrated*. From the Latin words *dis*, asunder, and *integer*, the whole, or entire.

[b] *Metals* are subject to similar influences. When iron, for example, is exposed to air and damp, its surface, however well polished, is soon covered or converted into reddish particles called *rust*. These particles gradually fall off, and others succeed, till the whole is, in the course of time, converted into a kind of reddish earth called the *oxide of iron*.

But the wear and tear of solid rocks is not confined to the particles on the surface. The same influences from time to time cause large fragments to fall off; and it is of fragments so detached that the *gravel*, *pebbles*, and large *rounded* stones which are found on the sea shore and in the beds of rivers are formed. At first, they are rough and angular, but when subjected to the rolling of the waves on the sea shore, or to the action of running water in rivers, they, by grinding and rubbing against each other, gradually become smooth and rounded. The *rocky* beds over which they are carried or rolled, contribute to the effect produced.

[c] Without *sand* or *flint*, we could have no *glass* for our windows, nor for any other of the useful and important purposes for which this mineral is essential—from the common black bottle in daily use to the telescope in the hands of the astronomer. Nor could we even have *houses* without sand—at least houses built of *stone* or *brick;* for sand is a necessary ingredient in mortar; and also in the manufacture of bricks.

Similar observations might be made with regard to the various and important uses of *lime* and *clay*. The utility and necessity of the former to the mason, the farmer, the tanner, the soap-manufacturer, and the sugar-refiner, are well known; and without clay there could be neither bricks, nor slates, nor any of the beautiful and useful productions of our potteries, from the finest porcelain to the coarsest earthenware. The uses of lime and clay in the *Plastic* arts, and for many other purposes, are also well known.

If we had only the earth of *silex*, there could be no vegetation, for it is too *porous* to retain the necessary moisture. Of this, the sandy deserts of Africa and Asia are striking examples. But when siliceous earth is duly mixed with other soils, it improves them, and thus promotes vegetation. *Sand* mixed with *clayey* soil, for example, will correct its *stiffness;* and in this way, the moisture necessary for vegetation will be enabled to penetrate or filter through it. Similar observations might be made with regard to *calcareous* and *argillaceous* earths: the former is too dry and too hot for vegetation, the latter is too wet and too cold; but when mingled together, in due proportions, they correct and improve each other, and thus contribute to the general fertility of the soil. It is with this view that the farmer mixes *lime* with his cold *clayey* soils.

But though *clay*, without a due admixture of other earths, is unfit for vegetation, because it will not allow water to penetrate or filter through it, yet it is to this very quality, that we owe one of the necessaries, and, it might be added, one of the luxuries of life—we mean pure spring water. In page 60 we have briefly explained the origin and formation of *Springs*, *Brooks*, and *Rivers;* and we have only to add, that but for the *retentive* quality of clay, there could be no great reservoirs of water under the earth, and, consequently, no springs. "The water which falls in rain" would continue its downward progress, "through the pores and fissures of the mountains," and never again return to refresh and fertilize the earth, did it not, sooner or later, meet with beds or rocks of clay, which, in effect, say to it, "Thus far shalt thou go, and no farther."[a] It is, then, as we have already explained, collected in great natural cavities or reservoirs, and returned again to the earth in the form of springs, brooks, and rivers.

ROCKS.

In digging through the different earths which lie at or near the surface, we come to hard or consolidated materials which are called ROCKS. These rocks form what is called the CRUST of the earth; and, generally speaking, they are of the same materials as the earths which we have just described; the only difference being, that, in the earths, the materials are loose or unconsolidated, and in the rocks hard or consolidated.

This is the popular distinction between earths and rocks, but it should be noted, that in the language of *Geology*, the term *rock* is applied to every kind of earth, even to *peat*, as well as to stones, and masses of stone. The following table exhibits the four great classes of EARTHS and ROCKS, with the different degrees of consolidation. It also illustrates the general principle, that *lower* rocks or strata are *harder* or more consolidated than those which are above them, because they have been subjected to a greater pressure.

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[a] A knowledge of this fact leads us to line or form with clay the bottoms and sides of artificial reservoirs for water; as ponds and basins.

Siliceous.	*Argillaceous.*	*Calcareous.*	*Carboniferous.*
Sand,	Alluvial Clay,	Marl,	Peat,
Sandstone,	Laminated Clay,	Chalk,	Lignite,
Graywacké,	Slaty Shale,	Limestone,	Brown Coal,
Quartz Rock.	Clay Slate.	Crystalline Marble.	Common Coal.

As in the earths, some rocks are formed of only one simple mineral,[a] as flint, limestone, and clay-slates ; while others are composed of two, or more, as mica-slate and granite. The former are called *simple*, and the latter *compound* rocks. As in the earths, too, the most abundant materials of rocks are the simple minerals just mentioned, namely, flint, lime, and clay.[b] The other simple minerals which enter most frequently into the composition of rocks, are felspar, mica, hornblende, talc, chlorite, and oxide of iron.

Felspar is a hard mineral, usually of a cloudy white or red colour, which decays easily, and forms the fine clay used for porcelain. The soft, greyish crystals of granite, which can be easily scratched, are formed of felspar.

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[a] By *simple* minerals are here meant individual mineral substances, as distinguished from rocks of which they are the constituent parts. They are not simple in their own nature, for, when subjected to chemical analysis, they are found to consist of a variety of different substances. The most common species of Felspar, for example, is composed of about 64 per cent. of silica, 18 of alumina, 14 of potash, 2 of lime, and nearly 1 of oxide of iron. There are, according to the deductions of chemistry, no less than *fifty-four* simple or elementary substances.

[b] It is supposed that these minerals enter into the composition of the crust of the earth in nearly the following proportions : silex one half, clay one sixth, and lime one eighth. *Quartz* is silex in its purest form, and *kaolin* (of which porcelain is made) is the purest kind of clay. Lime is never found by itself, that is, without an admixture of something else. It has a great affinity for carbonic acid, and united with it, it forms carbonates of lime, or, as they are usually called, limestones. *Quick*, or pure lime is obtained by driving off the carbonic acid and other volatile matter, as is done in lime-kilns. United with sulphuric acid, it forms sulphates of lime, as gypsum, alabaster, &c. ; and with fluoric acid, fluates of lime, as fluor spar, &c. Shells and corals are formed principally of lime ; and also, the greater part of the bones of animals.

Mica is derived from a Latin word which signifies to *shine* or glitter. The bright glistening scales which we observe in granite, gneiss, and *mica*-slate, are formed of this mineral. It also occurs in minute scales in many sandstones, giving to them a bright silvery appearance. *Muscovy glass* is a variety of mica. It is often found in veins of granite and mica-slate, in *laminæ* (or thin plates) of more than a yard in diameter; and in Russia it is sometimes used instead of glass.

Hornblende is a hard mineral of a black or dark-green colour. It enters largely into the composition of several varieties of the *trap* rocks. When it occurs in granite instead of mica, granite is then called *syenite*.[a]

Talc is a transparent, foliated mineral, resembling mica, but softer, and not elastic. It is often used for tracing lines on wood, cloth, &c., instead of chalk, which is more easily effaced.

Chlorite (from the Greek word *chlōros*, green) is either of a crystallized or foliated structure. It enters largely into the composition of chlorite slate. *Green earth*, which enters into the composition of many trap rocks, is allied to chlorite.

Oxide of iron is another name for the *rust* of iron. See note b, p. 292. It is it that gives the reddish colour to many rocks, and mineral waters.

Bituminous[b] and *Saline* minerals also enter into the composition of certain classes of rocks. The great COAL masses are composed principally of the former, and ROCK-SALT of the latter. It is almost unnecessary to observe, that these two minerals are of the utmost importance to man, and hence they have been most abundantly diffused over the earth.[c] Refer to pp. 175, 189, and 258, in which the *Mineral Productions* of the earth have been classed and described.

Generally speaking, all the great rock masses in the earth, are composed of one or more of the preceding simple minerals. But as they are usually blended together in different forms and proportions, the result is, that we have a great number and variety of rocks. The principal or most abundant rocks are mentioned in this little sketch; and before going farther, the learner should provide himself with a good specimen of each.

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[a] So called from *Syene*, an ancient city of Egypt, about which this species of rock is found in great abundance. It was largely imported by the Romans for architectural purposes.

[b] *Bitumen* is derived from the Greek word *pitus*, the pine tree, from the resin of which *pitch* is made. See note, p. 258, for the different kinds and uses of bitumen.

[c] *Rock-salt* sometimes forms entire mountains. The valley of Cardona, in Spain, for example, is traversed by hills of solid salt, 600 feet high, which glitter in the sun like mountains of gems. See p. 259.

STRATIFIED ROCKS.

Having given a general description of the *materials* which enter into the composition of rocks, we shall resume our supposed examination of the CRUST of the earth. Passing through the EARTHS, and continuing our excavations, we, generally speaking, meet with different *strata*[a] or layers of rocks, one above another, in a certain determinate order, *which is never in any degree inverted*—that is, rocks of an older formation will never be found, in the order of stratification, above rocks which were formed at a more recent period;[b] or, in other words, *Primary* rocks will never be found above *Secondary*, nor Secondary above *Tertiary*; and the same principle applies to each of the *strata* of the different groups or formations.

It is not to be supposed, however, that the stratified rocks always, or indeed ever occur, in a regular and unbroken series. If this were so, the lower members of it would be beyond the reach, and beyond the knowledge of man. Some of them occur at, or near the surface in one place, and some in another; and in this way we have become acquainted with them all.

Generally speaking, the different strata are parallel to each other, and in a *horizontal*[c] direction; but in many places, we shall find that they have been broken up, distorted, and driven to, or near the surface, by rocks of a quite different character, which occur in *irregular masses*. The beneficial effect of this seeming irregularity has been stated in p. 61, to which the learner should refer.

In every part of the world in which similar examinations have been made, similar appearances have presented themselves; and hence the various rocks which compose the crust of the earth have been divided into two great classes, namely,

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[a] *Strata*, the plural of *stratum*, a Latin word which signifies strewed or spread; and also, a bed or layer.

[b] This fact is of great practical importance to the miner; for if in searching for coal, or any other mineral, he comes upon a stratum which, in its geological order, underlies the mineral he is in search of, he knows that further operations in that direction would be useless.

[c] *Horizontal.* Because they must have been originally deposited at the bottom of a sea or a lake, and consequently on a foundation which was *level*, or nearly so.

STRATIFIED and UNSTRATIFIED. Sandstones, limestones, and clay-slates are examples of the former class of rocks; and granite, and trap rocks, of the latter.

The terms AQUEOUS and SEDIMENTARY are also applied to the Stratified rocks, because, as has been shown by geologists, they were originally formed by *sedimentary* depositions in *water*. And the Unstratified rocks are also called IGNEOUS and VOLCANIC, because it is supposed that they were originally formed by *fire* in the internal parts of the earth, and driven up from *below*, and *through* the stratified rocks by earthquakes and *volcanic* agency. From this circumstance they are also called ROCKS OF ERUPTION; as by Humboldt, in his "Cosmos."

If these conclusions and suppositions be true—and there can be no rational doubt of it—what astounding changes must have taken place in the earth before it was finally prepared for the abode of man! In countries far remote from the sea, and even on the summits of the highest mountains,[a] are found vast quantities of sea-shells, and other marine deposits, which is a proof that they were at one period submerged under the waters of the ocean. And in many cases, it appears that "the dry land" and "the waters" must have changed places repeatedly; and for long periods of time.[b] The whole series of *stratified* rocks, even those which are now buried thousands of feet deep in the earth, must have been formed, *one after another*, in this way.[c] That is, each stratum, in succession, must at one period or another, have been formed, either at the bottom of a sea, or of a fresh-water lake into which large rivers disembogued.

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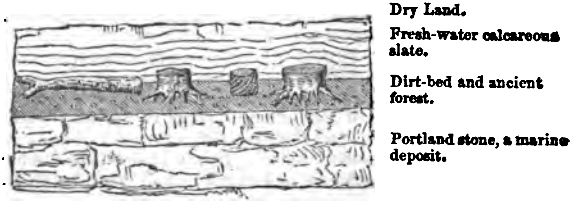
[a] The sides of the banks of rivers which flow through hilly countries, or through deep ravines, often exhibit extensive and satisfactory specimens of stratified rocks in their natural order of superposition. Similar specimens may also occasionally be seen on high headlands or cliffs, adjoining the sea shore.

[b] Fossil shells, of forms such as now abound in the sea, are met with far inland, both near the surface, and at all depths below it, as far as the miner can penetrate. They occur at all heights above the level of the ocean, having been observed at an elevation of from 8,000 to 9,000 feet in the Alps and Pyrenees, more than 13,000 feet high in the Andes, and above 15,000 feet in the Himalayas.—*Lyell.*

[c] During the process of deposition, each separate layer was once the uppermost, and covered immediately by the water, in which aquatic animals lived. Each stratum, in fact, however far it may now lie beneath the surface, was once in the state of loose sand or soft mud at the bottom of the sea, in which shells, and other bodies, easily become enveloped.—*Lyell.*

The following sketch of a section of a cliff in the Isle of Portland is an illustration of this on a small scale:


Dry Land.
Fresh-water calcareous slate.
Dirt-bed and ancient forest.
Portland stone, a marine deposit.

The lowest beds must, at one period, have been at the bottom of the sea, because they consist of *marine* deposits; for Portland stone is an *oolite* limestone. At a subsequent period, these beds became dry land, and trees grew upon it. At another period, this land, and the trees upon it, were submerged under *fresh water;* and above them, in the course of time, were deposited strata or layers of fresh-water calcareous slate. And finally, the waters having left these new beds, they became dry land again.[a]

PRIMARY ROCKS.

When the waters of the great deep first swept over the earth, neither animals nor vegetables existed; and consequently in the strata then formed, there are no traces of organized matter. These strata are lowest down in the series, and the term *Primary* has been applied to them, because it is supposed that they were formed previous to the existence of animals and vegetables; and also previous to the formation of the other rocks. The latter supposition is founded on the fact, that in rocks of this class no fragments of any other rock have been found.

The Primary rocks are distinguished by their *slaty* and *crys-*

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[a] The position of the *Wealden* clay, which is a fresh-water formation, with regard to Chalk and Greensand, which are *marine* deposits, is another striking illustration of the fact stated in the text. Speaking on this point, Sir C. Lyell observes—"It has been already seen that the chalk and greensand have an aggregate thickness of 1,000, or sometimes 1,500 feet. It is, therefore, a wonderful fact, that after penetrating these rocks, we come down upon a subjacent *fresh-water* formation, from 800 to 1,000 feet in thickness."

talline[a] structure. They are also very hard and *compact*,[b] and as has been already stated, quite destitute of organic remains. The principal rocks of this class are gneiss rocks, mica, talc, and chlorite schists,[c] quartz rock, crystalline limestone, and clay slates.

The Primary rocks overlie the granite or *igneous* rocks; and it is supposed that they owe their *crystalline* texture to their having come into contact with them when they were in a high state of temperature. It is also supposed that they originally contained some organic remains, and embedded fragments of other rocks; but that all traces of them were obliterated by the intense heat to which they were subjected. In this way, dark limestones, replete with shells and corals, have been turned into white statuary marble; and hard clays into mica and hornblende schists. Sir C. Lyell proposes that these rocks should be called *Metamorphic;* and he shows clearly[d] that the term "Primary" as applied to them is erroneous; but as his theory has not yet been fully adopted, we retain, for the present, the old terms, "Primary," "Transition," &c.

TRANSITION ROCKS.

After the formation of the Primary Rocks an important change began to take place in the world; for in the strata next formed, are found a few fossil remains of *zoophytes*, and *marine* shells, which is a proof that, at this period, animal life had commenced in the waters of the ocean. To this class of rocks the term *Transition*[a] has been applied, because they were considered by the older geologists as forming a *transition* or passage from the Primary rocks, which contain no fossil remains of any kind, to the Secondary rocks, which contain numerous fossils, not only of sea, but also of *land* plants and animals.

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[a] *Crystal.* "Simple minerals are frequently found in regular forms with facets like the drops of cut glass of chandeliers. Quartz being often met with in rocks in such forms, and beautifully transparent, like *ice*, was called *rock crystal;* the word in Greek properly signifying a piece of *ice*. Hence the regular forms of other minerals are called crystals, whether they be clear or opaque. By *crystalline* is meant the internal texture which regular crystals exhibit when broken, or a confused assemblage of ill-defined crystals. Loaf-sugar and statuary marble have a *crystalline* texture. Sugar-candy and calcareous spar are *crystallized*."—*Lyell.*

[b] *Compact.*—That is, the grains or particles of which they are formed are so minute as not to be distinguished by the naked eye. *Granular* is the opposite of compact; and hence the terms *granite* and *granitic.*

[c] *Schists.* This term is applied to rocks easily split up into *slaty-like* plates or divisions. It is derived from the Greek word *schisma*, a splitting up, or division.

[d] When it was thought, as formerly, that all rocks were of aqueous formation, granite, as being the lowest, was naturally considered as having been the first formed; and it was therefore denominated "Primitive" or "Primary." But after "the Neptunian theory" had be

The Transition rocks, as has been already stated, contain only a few marine fossils, and they are all of the lowest class or order, as zoophytes, corals, and shells. They consist principally of thick beds of sandstones, shales, slates, and limestones, and are usually called Greywacké,[b] Cambrian, or Silurian rocks.

SECONDARY ROCKS.

Under the name of *Secondary* rocks are comprised all the formations, systems, and groups, from the Transition to the Tertiary rocks.

The term *Formation* is applied to rocks which seem to have been formed under nearly similar circumstances; and the term *System*, to rocks which are found to have nearly the same mineral and fossil character. Under one formation there may be several systems; and under one system, several *groups*.

Geologists have not yet agreed upon[c] an exact classification

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abandoned, and the *igneous* origin of granite admitted, the terms in the sense in which they had been applied, became objectionable, and in many cases, erroneous; for instead of forming the oldest part of the earth's crust in all cases, as had been formerly supposed, some granites are of comparatively recent formation—in fact, newer than the stratified rocks which they have disrupted, and in some cases, rendered crystalline. Or, in the words of Sir C. Lyell, "Some granites and granitic schists are of an origin posterior to many secondary rocks. In other words, some *primary* formations can be shown to be newer than many *secondary* groups—a manifest contradiction in terms."

[a] *Transition*. This term was applied to rocks of this class by Werner, the great German geologist, on the supposition that they formed a step or transition from the primitive state of the globe to that condition of it in which it began to be inhabited by living bodies.

[b] Or *Grauwacké*, which, in the language of German miners, signifies *grey rock;* many of the rocks of this class being of a grey colour. These rocks abound in some parts of Wales, and in Shropshire, the country of the ancient *Silures;* and hence the terms *Cambrian* and *Silurian*.

[c] The fossiliferous strata have been variously grouped according to the comparative value which different geologists have attached to different characters; some having been guided chiefly by the thickness, geographical extent, and mineralogical composition of particular

of the Secondary rocks. They are usually, however, divided into four great systems, each of which contains several groups or sub-divisions: 1. Carboniferous; 2. Saliferous; 3. Oolitic; 4. Cretaceous or Chalk.

Under the *Carboniferous* system may be grouped, beginning with the lowest, Old Red Sandstone, Mountain Limestone, and the Coal Measures; under the *Saliferous*[a] System, Magnesian Limestone, New Red Sandstone, and Saliferous Marls; under the *Oolitic*[b] System, Lias[c] Limestones, Oolitic Limestones, and Wealden Clay; and under the *Cretaceous* System, Lower Greensand, Gault, Upper Greensand, and Chalk.

In ascending this great series of rocks the *fossils* become more numerous, and of a higher order; but as in the Transition rocks, they all belong to extinct species of animals and plants. In the Old Red Sandstone, or lowest rocks of the series, are found, in addition to a greater number and variety of corals and marine shells, the fossil remains of peculiarly formed *fishes*. This proves that, at this period, the formation of *vertebrated* animals had commenced in the waters of the ocean. In the Mountain Limestone, corals and marine shells are very numerous; and in the coal strata we find for the first time, the fossil remains of *land* plants, *fresh-water* shells, and fishes of the *sauroid* family; that is, half fish, half reptile.

Long before the Coal formations, large portions of the surface of the earth had become dry land; and the vegetation which covered it, must have been of the most luxuriant kind. All the *coal* and *peat* which are found in so many parts of the earth, and in such abundance, were formed from the immense forests and gigantic plants which flourished at that period. Nearly 500 distinct species of plants and trees have been discovered in the coal strata, the majority of which resemble gigantic ferns, canes, and bamboos. Some of these *tree* ferns, as they are called, must have been between forty and fifty feet high; and their trunks vary from half-a-foot to five feet in diameter.

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sets of strata; others by their organic remains. All, however, seem now agreed that it is by a combination of these characters that we must endeavour to decide which sets of strata should be entitled to rank as principal and independent groups.—*Lyell.*

[a] *Saliferous.* That is, *salt bearing* or containing. It is in these formations or groups that *salt* is principally found. See p. 259.

[b] *Oolite.* The term *oolite* is derived from the Greek *öon*, an egg, and *lithos*, a stone; and it has been applied to this kind of limestone, because it consists of rounded particles like the roe or *eggs* of a fish.

[c] *Lias* is a provincial corruption of *layers*, in allusion to their regular stratification.

Of the vegetable origin of coal there can be no doubt. When slices of it, thin enough to admit the light, are minutely examined, its vegetable structure is distinctly perceptible; and it is not unusual to find, in coal beds, the trunks of trees half converted into coal. These wonderful and most important results were principally produced by the agency of *heat* and *pressure*. Or, in other words, to the deluges, earthquakes, and volcanoes, which overwhelmed, and buried in the earth, these *primeval* trees and plants, we owe the *coals* which we burn in our houses, our factories, and our steam-ships!

The *Oolitic* formations, from the Lias to the Wealden groups inclusive, are remarkable for the number and variety of the fossils which they contain; particularly of *sauroid*[a] animals. In these strata are found *saurians*, *ichthyosaurians*, and *plesiosaurians*,[b] in such numbers, and in such varieties, that this period in the world's history has been called the "age of reptiles." These creatures resembled gigantic *lizards* or crocodiles; and some of them were adapted for inhabiting the water; others for living upon land; and some were amphibious in their nature. Some of them, too, as the *pterodactyles*,[c] had wings, like bats, which enabled them to fly in the air! The *Wealden*[d] group is particularly remarkable for its fossils of gigantic *land* reptiles, including the *iguanadon*,[e] which was fully seventy feet in length. In this group, too, animals of the *mammalia* kind begin to make their appearance; but the only specimens yet found are of the *marsupial* order, and of small size: something like small kangaroos, or opossums.

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[a] *Sauroid.* This term is derived from two Greek words which signify *like* or resembling a *lizard*. *Ichthyosaurus* means the *fish* lizard, and *plesiosaurus* implies, that the creature was *nearer* or more like a lizard than a fish. To several other species of these creatures names have been given; as *megalosaurus*, the great saurus; *geosaurus*, the land saurus; *hylæosaurus*, the forest saurus; *teleosaurus*, the perfect saurus, &c.

[b] *Plesiosaurus.* This animal had the head of a lizard, the teeth of a crocodile, and the body of a serpent. Its neck was of enormous length, exceeding, in some of the species, that of the remainder of the body. It appears to have lived in shallow seas and estuaries; and while swimming it is supposed that it kept its neck arched like that of a swan, darting it down at the prey within reach. Prodigious numbers of their remains are found in the Lias group; and some of them must have been upwards of twenty feet long.

[c] *Pterodactyles.* From the Greek *pteron*, a wing, and *daktylos*, a finger. Eight species of flying-lizards have been discovered, of sizes varying from that of a snipe to that of a cormorant. The second digit of the fore-feet was of extraordinary length, with which it is supposed it partly supported its wings; and hence its name.

[d] *Wealden.* These formations are fully developed in the *wealds* or *wolds* of Kent and Sussex; and hence the term *Wealden*.

[e] *Iguanadon.* It had two rows of *teeth*, like the *iguana*; and hence its name.

The *Chalk* formations are remarkable for the number and variety of their *marine* fossils; as corals, shells, fishes, and turtles. In some cases, chalk is almost wholly formed of minute shells and corals.

TERTIARY ROCKS OR FORMATIONS.

The *Tertiary* rocks, or formations, comprise all those regularly stratified beds which occur above the Chalk system. They consist of marls, imperfect limestones, gypsum, sandstones loosely aggregated, lignite or half-formed coal, blue and plastic clays, &c. They were formerly considered as mere superficial accumulations, confined to certain localities; but when it was found that they consisted of regularly stratified beds, and that the organic remains which they contained could be referred to definite periods in the earth's history, they were classed as Tertiary rocks or formations. They are not of general occurrence like the other rocks, but are usually confined to *basins* near rivers and estuaries. And it is remarkable that the two great cities of London and Paris have been built on two such basins, that is, basins full of Tertiary formations. Hence the terms *London clay*, and *Plaster of Paris*.

The Tertiary formations have been divided by Sir C. Lyell into the Eocene, the Miocene,[a] and the Pliocene,[b] groups or periods. The term *Eocene* is derived from the Greek word *eōs*, the dawn, and *kainos*, new or recent; and it has been applied to the oldest groups of the Tertiary formations, because it is in these groups that the remains of animals of the same species as those which now exist, make their *first* appearance. For, as has been already stated, all the organic remains found in formations preceding the Tertiary, belong to species of animals which had disappeared from the earth before it was finally prepared for the reception of man. In the Eocene strata, the proportion of existing to extinct species of animals is about 3½ per cent.; in the Miocene, or *less* recent, 17; in the Older Pliocene or *more* recent, from 35 to 50; and in the Newer Pliocene, from 90 to 95.

The strata of the London and Paris basins are Eocene deposits. Deshayes enumerates 1,238 species of fossil shells as belonging to the Eocene group, only 42 of which have been identified with species now existing. And of forty species of

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[a] *Miocene* is from the Greek *meion*, less, and *kainos*, new or recent.

[b] *Pliocene* is from the Greek *pleion*, more, and *kainos*, recent.

Pachydermatous quadrupeds which existed at that period, some of which equalled the horse, and others the rhinoceros, in size, there are only four living representatives, namely, the daman of the Cape, and three species of the tapir. Of these ancient animals the *palæotherium*[a] was the the most remarkable; ten or eleven distinct species of which have been discovered in the gypsum beds of Paris.

It is also remarkable that the organic remains found in the deposits of this period prove that the temperature in these latitudes was widely different from what it is at the present day. In the Eocene deposits in England and France, for example, are found the remains of animals and vegetables, which indicate that these countries then enjoyed a tropical climate. In the Paris basin, mastodons, elephants, rhinoceroses, hippopotami, crocodiles, and turtles have been discovered; and in the London clay, more than one species of monkey, and several species of the palm tree. And in gravelly deposits on the banks of the Thames, tusks and other remains of the mammoth,[b] mastodon,[c] and other tropical animals, have been found. The beds of lignite also indicate a tropical luxuriance of vegetation; and it is worthy of remark, that such vegetation was necessary for the support of the huge graminivorous animals that then replenished the earth.

Miocene deposits are not known to exist in England; but they are met with in France and other countries in Europe. The *dinotherium*[d] was the most remarkable of the extinct species of quadrupeds which belonged to this period. It seems to have been the largest of all terrestrial animals; its head measuring four feet long and three broad, with immense tusks bent downwards. It is supposed to have been a herbaceous animal, of aquatic habits, and in construction, it resembled the living tapir. Its gigantic remains have been found in great abundance at Epplesheim, in Hesse-Darmstadt.

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[a] *Palæotherium* from the Greek words *palaios*, ancient, and *therion*, a wild beast.

[b] *Mammoth.* The primitive, and largest species of elephant. It is now extinct, but its fossil bones are met with in various countries; and in the year 1803, a whole carcass of one was found embedded in ice, near the mouth of the Lena, in which it must have lain for thousands of years! In the same locality, the bones of mammoths are so abundant that a Russian naturalist has stated it as his belief, that the number of elephants now living on the globe, must be greatly inferior to those which occur in a fossil state in those parts of Siberia.

[c] *Mastodon.* An extinct species of proboscal animal allied to the elephant. Its teeth had their surface covered with conical mamillary crests; and hence its name: from the Greek *mastos*, a pap, and *odous*, (*odontos*) a tooth.

[d] *Dinotherium.* From the Greek words *deinos*, terrible, and *therion*, a wild beast.

Pliocene deposits are met with in various parts of Great Britain and Ireland; as in Cornwall, and near the estuaries of the Forth, the Clyde, and the Shannon. The *Norfolk crag*, and the red or *coralline crag*, met with in Suffolk, are Pliocene formations of the Older period.

Having given a general description of the *Stratified* rocks, from the lowest in the series to the highest, we shall return to the other great class, of which we spoke in page 297, namely, the

UNSTRATIFIED OR IGNEOUS ROCKS.

The *Unstratified* or *Igneous* rocks are usually divided into three classes: Granitic, Trap, and Volcanic.

The *Granitic* are the most abundant of all rocks. They extend to the greatest depths yet penetrated by man; and while they seem everywhere to form the foundation on which the other rocks rest, they are frequently found, not only at the surface, but in many cases far above it; for most of the hills and mountains in the world are composed of granitic rocks. They are also called *Plutonic* rocks, because it is supposed that they were formed by the agency of *fire* in the interior of the earth, and upheaved from it in a fluid, or semi-fluid state, like *lava* from a volcano. Like lava, too, they frequently penetrate the rocks with which they come into contact, in the form of *dikes* and *veins*, altering their texture and original appearance (see page 299). The granitic rocks are easily distinguished by their *granular* and crystalline texture, and also by their hardness and massy appearance. Their great hardness is owing to their having cooled slowly under enormous pressure, namely, that of the superincumbent or overlying rocks.

Granite makes a beautiful and durable building stone; and it is much used in the construction of piers, harbours, bridges, and roads.

Besides the common granite, there are several varieties, as syenite, porphyrite, protigine or talcose, schorl, primitive greenstone, serpentine, &c.

The *Trap* rocks are of a darker and less crystalline texture than the granitic, and are supposed to be the products of volcanoes long since extinct. It is also supposed that they were once in a state of fusion, like the granitic rocks, and that they were cooled down under the pressure of deep water, probably of a profound ocean. They derive their name from the Swedish word *trappa*, a stair; because many of the rocks this class occur in great tabular masses of unequal exter as to form a succession of terraces or steps on the sides o

They also occur in shapeless lumps and irregular cones, forming small chains of hills; and, frequently, in the form of dikes or wall-like masses, intersecting fossiliferous beds. Occasionally, too, they are found in the form of columns or pillars, which are usually called *basaltic columns*. The Giant's Causeway, in the North of Ireland, and Fingal's Cave, in the Isle of Staffa,[a] contain wonderful examples of formations of this kind.

Basalt[b] is one of the most abundant rocks of this class. The other varieties are greenstone, clinkstone,[c] claystone, trachyte,[d] porphyry,[e] and amygdaloid.[f]

The *Volcanic* rocks, as the name implies, are the products of recent or active volcanoes. They are less crystalline, and less compact than either the granitic or trappean rocks, which is supposed to be owing to their having cooled in the open air, and not under pressure. The principal rocks of this class are lava, obsidian,[g] pumice-stone, scoriæ, and tufa.

In the "Chapter on Mountains," page 62, the names of the principal volcanoes at present in operation have been given, to which the learner should refer. It will be seen that they are as active amid the perpetual snows of the polar regions as under the scorching rays of the torrid zone. And though their eruptions are sometimes attended with the most calamitous results, it will be found that they are, upon the whole, beneficial in their uses. In fact, they may be regarded as great natural *safety-valves*, for preserving the districts of country in which they are placed, from the still more calamitous effects of EARTHQUAKES. One proof of this is, that, in volcanic regions, earthquakes have been known to cease the very moment that eruptions commenced from volcanoes in the same district. And occasionally, eruptions from volcanoes in districts comparatively remote, have had a similar effect; which also proves that in certain portions of the globe there must be vast subterranean cavities, communicating with each other to the extent of hundreds of miles. When we hear, therefore, of the terrific and destructive effects of volcanic eruptions, we may be very sure that the consequences would have been still more disastrous if the irresistible force which produced them had not spent itself in this way. In fact, if it had not found a vent through the craters of volcanoes, it would have broken up the crust of the earth, and, perhaps, swallowed up whole cities and districts.

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[a] *Staffa.*—This island evidently owes its name to the *staff*-like form of the columns.

[b] *Basalt* is derived from *basal*, an Ethiopian word, signifying iron. These rocks often contain much iron.

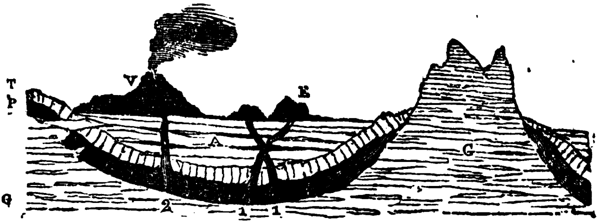
[c] *Clinkstone* owes its name to the metallic or ringing sound which it emits when struck with a hammer.

[d] *Trachyte* is derived from a Greek word, which signifies *rough*. This rock has a peculiarly *rough* feel.

[e] *Porphyry* is from a Greek word signifying *purple*. It was originally applied to a *reddish* rock found in Egypt, and used by the ancients for statuary purposes; but it is now extended to all igneous rocks, whatever their colour, which contain embedded crystals of felspar, or any other mineral distinct from their mass. Such rocks are called *porphyritic*.

[f] *Amygdaloid*, from two Greek words, signifying *like an almond*. In such rocks, agates and simple minerals are scattered like almonds in a cake.

[g] *Obsidian* is a glassy lava, of various colours, but usually black. It was so called from Obsidius, who first discovered it.



The preceding diagram will serve to illustrate the different classes of rocks of which we have spoken. The lowest rock, which is represented by the letters G, G, is supposed to be *Granite*. Those lying next to it, (P, T,) which it has upheaved from their original horizontal position, and at the right, entirely broken through, are *Primary* and *Transition* rocks. The Primary, which is supposed to have been altered by the heat of the underlying granite, is also called *Metamorphic* (see page 299). A represents strata deposited above the primary and transition rocks after their upheaval. E, 1, volcanic matter breaking through all the strata in the form of *dikes*, and also spreading between them, and forming above large tabular masses and irregular cones, as at E. These are *Trap* rocks; and the volcanoes which ejected them are supposed to be extinct. V, 2, represents the erupted matter of an active volcano.

CONGLOMERATE ROCKS.

When rounded fragments of rocks, or pebbles, are cem together by another mineral substance, so as to form rock, the whole mass is called *Conglomerate*,[a] and sometimes *Pudding-stone*. When angular fragments are thus cemented, the term *Breccia*[b] is substituted. The substance cementing may be of a siliceous, calcareous, or argillaceous nature (see page 293).

SUPERFICIAL ACCUMULATIONS.

All loose and irregularly deposited materials at, or near the surface of the earth, are called *Superficial Accumulations*. They consist principally of masses of sand, gravel, clay, marls, animal and vegetable drift, debris, and boulders; and are usually divided into *Diluvium*,[c] *Alluvium*, and *Soil*.

The diluvial deposits,[d] contain large rounded stones called *boulders* or *erratic blocks*; and also the bones of large extinct animals, as the mammoth and mastodon, in places to which the forces of no water now in action, could have transported them.[e] It has therefore been supposed that they were carried to those places by the waters of the Deluge; and hence, to *drift* or deposits of this kind, the term *diluvial* has been applied.

Many of these boulders are from ten to twenty tons weight; and some of them must have been carried, not only from one part of a country to another, but also from continental countries to distant islands. In England, for example, are found boulders which must have come from the mountains of Norway; and immense blocks of Finland granite are scattered over the plains of Russia.

Boulders are usually of *granite* and other primitive rocks; and of all sizes from that of an egg to masses weighing several tons. They are either embedded in clay, or scattered loosely over the surface.

Connected with the diluvial deposits should be mentioned the remarkable OSSIFEROUS, or bone-containing caverns which have been found in all parts of the world, from the British Islands to Australia. In these ancient caves, mixed with deposits of mud or gravel, and usually covered over with calcareous incrustations, are found large accumulations of the bones of animals, many of which belong to species found only in other regions of the earth.

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[a] *Conglomerate* is derived from two Latin words, which signify to gather into *a ball*.

[b] *Breccia* is from an Italian word, signifying *broken*. It is pronounced *brek'-shĕ-ŭ*

[c] *Diluvium* in Latin signifies a *deluge*. It is derived from *luo* to wash, and *dis*, asunder. *Alluvium* is from the same root, and *ad*, to.

[d] Diluvial deposits are found containing the remains of animals now extinct, at the height of 16,000 feet on the Himalay Mountains, and 7,000 feet on the Andes. They also contain fragments of other rocks found only in distant countries, which nothing but such a violent convulsion could have transported.—*Buckland.*

[e] The transportation of boulders, or erratic blocks, has been recently attributed to the agency of *glaciers* and *icebergs*. This theory has been advanced by Sir C. Lyell, and he has ably supported it by proofs and illustrations.

In Kirkdale cave, in Yorkshire, for example, were found the bones of elephants, rhinoceroses, hippopotami, tigers, hyænas, bears, and wolves, mingled with the bones of horses, deer, oxen, foxes, hares, rabbits, ravens, pigeons, ducks, &c. There are several similar caves in England; but this is the most remarkable one.

The ALLŬVIAL deposits have been formed by the action of rivers, and other causes still in operation. The extent of the alluvions deposited at the mouths of rivers, and in the valleys which they periodically, or occasionally overflow, will enable us to form some idea of the vast amount of earthy, rocky, and vegetable matter which they carry with them in their course. It was a saying of the Egyptian priests, even before the time of Herodotus, that "Egypt was the gift of the Nile;" and in fact, the whole of Lower Egypt, or, as it is usually called the *Delta*, was formed by the alluvial matter carried down by its waters.

There are evidences to show that the base of the rocks on which the Pyramids of Memphis stand, was, at some former period, washed by the waters of the sea. These Pyramids are now about a hundred miles from the Mediterranean, and the ground at their base is 60 or 70 feet above the level of its waters.

Even within the historic period, the extension of the Delta of the Nile has been considerable;[b] and the changes which have taken place in it since it entered the sea by seven large mouths, are obvious and remarkable. Most of its ancient mouths have been filled up with alluvial matter; and rocks and islands which were formerly at some distance from them, as Canōpus[c] and Pharos, are now connected with the mainland. The town of Damietta, too, whose walls were formerly washed by the sea, is now some miles distant from it; and the same may be said of Rosetta.

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[a] *Delta.* Strictly speaking, the Delta comprised the large *triangular* tract of country between the western and eastern branches of the Nile, and the Mediterranean sea. It was so called, because it resembles in shape the Greek letter Δ (*Delta* or D). The term has since been extended to the alluvial tracts of land between the branches or mouths of other rivers.

[b] The extension of the Delta has been checked of late years by powerful littoral currents, which carry off the new alluvions to other parts of the Mediterranean.

[c] *Canopus*, in the time of Scylax, the geographer, was an insular desolate rock.

Similar changes are known to have taken place in other parts of the Mediterranean. In the delta of the Rhone, Notre Dame des Ports, which was a harbour in 898, is now a league from the shore; and in 815, Psalmodi was an island, but it is now two leagues from the sea. And the watch-tower of Tignaux, which was erected on the verge of the sea in 1737, is already a French mile inland.

About the mouths of the Po and Adige similar changes have taken place. The town of Adria for example, was a seaport in the time of Augustus; but it is now 14 miles distant from the sea on which it stood, and to which it gave its name. Ravenna, which was also a seaport, is now 5 miles inland.

In many other parts of the world the alluvions of rivers are even more extensive. The land at the mouth of the Mississippi has advanced 15 miles within the last century; and it has been calculated that the alluvial matter carried down annually by the waters of the Ganges would, if collected, and in a solid state, contain upwards of 6,000 millions of cubic feet.[a] This, according to Sir C. Lyell, would more than equal in weight forty-two of the great Pyramids of Egypt,[b] supposing them to consist of solid masses of granite. Or, according to another computation, if a fleet of eighty Indiamen, each freighted with 1,400 tons weight of sand, were to sail down the river every hour of every day and night for four months continuously, they would only transfer from the higher country to the sea, a mass of solid matter equal to that borne down by the Ganges in the flood or rainy season.[c] During this season, which lasts for four months, the mud brought down by the river discolours the waters of the Bay of Bengal for 60 miles from the shore.[d]

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[a] The delta of the Ganges is more than double that of the Nile; that part of it alone which is called the *Sunderbunds*, being equal in extent to the whole principality of Wales. Its whole area is supposed to contain 44,000 square miles. The delta of the Niger is also very extensive, its area being estimated at 25,000 square miles, that is, nearly as large as the whole of Scotland.

[b] The base of the great Pyramid covers thirteen and a half acres of ground, and its perpendicular height is 479 feet.

[c] Yet in addition to this, it is probable that the Burrampooter conveys annually as much solid matter to the sea as the Ganges.—*Lyell.*

[d] It has been stated that the muddy waters of the Amazon may be distinguished during the rainy season for 300 miles from its mouth; and it is the alluvial matter brought down by the great Chinese rivers, the Hoang Ho, and the Kiang Ku, that not only colours, but is also gradually silting up, or shoaling the *Yellow Sea.*

When rivers flow into, or even pass through lakes, similar results are produced. For when a river enters a lake its velocity is checked; and the alluvial matter which was held in suspension by the motion of its waters, sinks by its own gravity, to the bottom; the heavier substances first, as gravel; then sand; and ultimately the finest mud. In such cases, lakes are gradually silted up, and their beds or basins are ultimately changed into alluvial land.

The beautiful lake of Geneva, for example, is gradually going through this process. In the time of the Romans, Port Vallais stood on the margin of the lake, but it is now more than a mile and a half inland. It is at this end of the lake the Rhone enters, and its waters on entering are turbid and discoloured; but on issuing from it at the other end, they are beautifully clear and transparent.

The same process is going on in the great American lakes, particularly in Lake Erie, which, according to Sir C. Lyell, is rapidly filling up.

Besides the constant formation of new land, at the mouths of rivers, by the influx and deposition of earthy matter, and the gradual silting up of lakes from the same causes, it often happens that large portions of the bed of the ocean are elevated by volcanic and subterraneous agency,[a] above the level of the water, and converted into dry land. In this way, from time to time, new islands are formed, and large additions made to the coasts of countries in various parts of the world. The labours of the coral insects, too, are constantly and wonderfully adding to the amount of the dry land; for the reefs and islands which they raise above the surface are, in process of time, converted into land fit for the abode of man.

We are not to conclude, however, that the relative proportions between the land and water on the earth's surface are undergoing any material alteration; on the contrary, we may suppose that, upon the whole, they continue much the same. What the land gains in one place, it loses in another; for ample and sometimes terrible reprisals are made by the ocean.[a] In fact, it is essential to the habitable condition of the globe that their relative proportions, should, upon the whole, remain undisturbed; and this, we see, has been provided for by the establishment of agencies which counteract and counterbalance each other. It is also essential to animal and vegetable life that there should be mountains and inequalities on the surface of the earth, and this has been assigned as the work of igneous and subterraneous agencies. For if the effects of aqueous and atmospheric agencies were not counteracted, the surface of the earth would, in process of time, be reduced to the level of the sea. "The war of elements," therefore, so far from having a destructive tendency, is, upon the whole, conservative in its effects.

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[a] Sometimes these elevations are sudden and violent, and sometimes gradual and insensible. There are instances of mountains and islands having been thrown up in a few days, and even in one night, during earthquakes and volcanic eruptions; and in various parts of the world, it has been ascertained that extensive districts of country are gradually rising above their former level. The northern shores of the Baltic, for example, are gradually and slowly rising. Many places which a century ago were on the level of the sea, are now several feet above it. This has been fully proved by Sir C. Lyell.

It should be noted here, that the surface of the earth and the bottom of the sea are subject to *depressions* as well as *elevations*; and that they are produced by the same agencies, and in the same way—that is, sometimes suddenly and with violence, and sometimes slowly and imperceptibly.

"All nature is but art unknown to thee;
All chance, direction which thou canst not see;
All discord, harmony not understood;
All partial evil, universal good."

In connexion with the diagram on the next page, page 296 should, in particular, be read; otherwise an erroneous idea might be taken up with regard to the regularity of the stratification of the rocks which form the crust of the earth.

The following table from Phillips's "Guide to Geology" will enable us to form an idea of the aggregate thickness of the thousands of strata contained in the several lines, and also of the number of organic remains which they severally contain.

Strata.	General thickness, in feet.	No. of Organic Remains in 100 feet of thickness.
Tertiary,	2,000	141
Cretaceous,	1,100	70·7
Oolite,	2,500	45·6
Saliferous,	2,000	8·2
Carboniferous,	10,000	4·7
Primary (including Transition),	20,000	2·0

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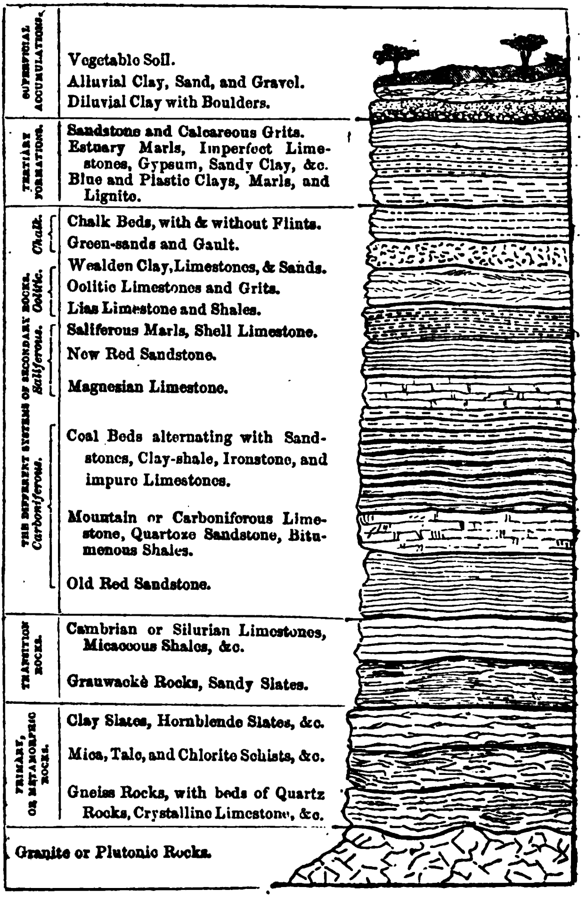
[a] The very elevation of the bed of the sea often leads to the submergence of land; for if the adjoining coast be low, the displaced water will naturally flow over a portion of it. "*Submarine Forests*" may be accounted for in this way. It should be noted, however, that when there is an elevation of the bed of the sea, there may occur, at the same time, a corresponding depression of it, and that in such a case the adjoining coast would not be submerged; and in fact, the sinking down of the bed of the sea is one of the means by which the submergence of land is prevented.

CRUST OF THE EARTH.

This Diagram represents the order of succession of the different Strata which form the Crust of the Earth. (See p. 296).



SUPERFICIAL ACCUMULATIONS.		Vegetable Soil. Alluvial Clay, Sand, and Gravel. Diluvial Clay with Boulders.
TERTIARY FORMATIONS.		Sandstone and Calcareous Grits. Estuary Marls, Imperfect Limestones, Gypsum, Sandy Clay, &c. Blue and Plastic Clays, Marls, and Lignite.
THE DIFFERENT SYSTEMS OF SECONDARY ROCKS.	*Chalk.*	Chalk Beds, with & without Flints. Green-sands and Gault.
	Oolitic.	Wealden Clay, Limestones, & Sands. Oolitic Limestones and Grits. Lias Limestone and Shales.
	Saliferous.	Saliferous Marls, Shell Limestone. New Red Sandstone. Magnesian Limestone.
	Carboniferous.	Coal Beds alternating with Sandstones, Clay-shale, Ironstone, and impure Limestones. Mountain or Carboniferous Limestone, Quartoze Sandstone, Bitumenous Shales. Old Red Sandstone.
TRANSITION ROCKS.		Cambrian or Silurian Limestones, Micaceous Shales, &c. Grauwackè Rocks, Sandy Slates.
PRIMARY, OR METAMORPHIC ROCKS.		Clay Slates, Hornblende Slates, &c. Mica, Talc, and Chlorite Schists, &c. Gneiss Rocks, with beds of Quartz Rocks, Crystalline Limestone, &c.
Granite or Plutonic Rocks.		

In the preceding sketch we have endeavoured to make the leading principles of Geology not only intelligible, but also interesting to young and inquiring minds; and we trust that we have to a certain extent succeeded. Even what we have written must show its great practical utility in connexion with mining, agriculture, engineering, architecture, and all the arts of life;[a] and though the subject (as Burke has said of geography), is an earthly one, it is a heavenly study; for no science, not even astronomy, more strikingly displays "the work of an Almighty hand." In fact, at every advance which the student makes in this wonderful science, he will find fresh proofs of the power, the wisdom, the goodness, and the unceasing superintendence of the Creator.

For the following "GEOLOGICAL SUMMARY" I am indebted to my friend, Mr. Young,[b] and I only regret that I cannot, for want of space, avail myself of more of his observations.

PRIMARY PERIOD.

Accepting the theory that our globe has passed from a state of intense heat to its present condition, by a gradual cooling process, its progress may be supposed to have been from a nebulous to a liquid, then to a viscid state, from which it would continue to cool down and solidify until it had reached a temperature at which moisture could be deposited upon its surface. When this stage was reached, the waters, hitherto suspended in a state of dense vapour in the surrounding atmosphere, would rush down in floods upon the still heated surface, disintegrating the rocky crust, and forming those PRIMITIVE sedimentary strata of vast thickness and coarse texture, which we find resting on the original granitic surface. These older sedimentary rocks are almost universally distributed; but they afford no evidence of the contemporaneous or previous existence of dry land; nor do they contain proofs of the existence of animal or vegetable life in the primitive ocean, from whose waters they were deposited.

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[a] Want of space has prevented us from pointing out the connexion between Geology and Physical Geography, which we had principally in view when we commenced this sketch. It will be obvious to the reader, however, that the Physical Geography of a country or district, will depend, in a great measure, on its Geological character. In primitive districts for example, the mountains, generally speaking, will be high and abrupt, the surface rugged and broken, the soil scanty and unproductive, and the rivers, from rolling over rocks and precipices, unfit for navigation. In such districts, too, deep glens, and abrupt precipices, and picturesque waterfalls will be frequent. Primary regions have also peculiar advantages. The springs of water are numerous and peculiarly pure, and the air is bracing, and, generally speaking, free from noxious exhalations. Such countries are, therefore, generally speaking, more healthy, and more favourable to human existence. It is also obvious that when primary countries are conterminous to the sea, they form bold and elevated coasts, with deep water, and harbours free from shoals.

[b] Author of "Young's Infant School Manual," an admirable little work, which I beg to recommend not only to the Teachers of National Schools, but to every person engaged or interested in the education of children.—R. S.

TRANSITION PERIOD.

Arriving at the Silurian system we meet with strata of a finer texture, indicating a more gentle and gradual mode of deposition, while the occurrence of organic remains proves that the surface of the globe had reached a temperature which allowed of the existence of vegetable and animal life. The existence of dry land is also indicated; yet the deposits of this period, often of great thickness, were, more or less, acted upon by the internal heat, after their deposition.

Before the close of the Transition Period, some limited portions of dry land had supported terrestrial vegetation; and the waters which had become fit for the support of marine zoophytes, abounded in coral reefs. After this period the internal heat no longer acted by metamorphoses of the deposited strata, yet it still continued to act convulsively in volcanic and disruptive phenomena. The upheaval of a mighty chain of mountains was a common event at this period of stupendous changes on the surface of our planet.

SECONDARY PERIOD.

On the undulating bed of the sea, around the bases of primary rocks, secondary deposits were formed, sometimes from the waste of primary strata, but often of purely marine origin, as are many of the calcareous beds. The *Carboniferous* deposits are generally supposed to have occurred during the existence of a climate of tropical heat, and in an atmosphere containing abundance of carbonic acid; for these conditions appear necessary to the existence of those dense and luxuriant forests, from which were derived the vast accumulations of vegetable matter, forming the coal beds which characterize this period. During the *Oolitic* period no great change in the relative level of land and sea seems to have taken place; the strata of this period being generally parallel to those preceding it; but a great thermal and atmospheric revolution must have occurred to cause the sudden appearance of those abundant forms of vegetable and animal life, including gigantic reptiles of land, river, and sea, whose fossil remains abound in these rocks. The general arrangement of the oolite strata greatly resembles the carboniferous; but there is no proof either of so high a temperature, or so abundant a vegetation, in the later as in the earlier period.

The rocks of the *Cretaceous* period are generally parallel to those of the oolitic system; indeed the transition from the one to the other is exceedingly gradual. The sands, soft white limestone, and chalk of this period indicate a sea essentially different in its chemical and vital action from that in which the oolitic rocks were deposited, yet the fossil remains still indicate a high temperature.

After the chalk formation was complete in the South of France, the Pyrenees were uplifted to a great height; and it is supposed that at the same time the Appenines and Carpathians experienced an upward movement. In Ireland eruptions of basalt of enormous extent cover the chalk, and indicate a crisis of volcanic action at the close of this period.

TERTIARY PERIOD.

In general, no contrast can be greater than that between the secondary and tertiary stratified rocks, the former retaining uniformity of character for enormous distances, while the latter exhibit an almost endless local variety, and bear evident relation to the boundaries of existing sea and land.

In the secondary strata the organized remains are strikingly different from existing species; while, in the tertiary deposits, it is the resemblance between fossil and existing species that first arrests the judgment.

With the tertiary system came into existence many races of quadrupeds and some birds, reptiles, and fishes extremely analogous to existing species; together with thousands of corals, shells, and crustacea, which present, with living species, quite as great an analogy as obtains between the tribes of the Atlantic and Pacific of the present day. From this period geology gradually approximates to physical geography. The phenomena of stratification are still repeated at various parts of the earth, and on a considerable scale. New land is in process of formation, while submergence and littoral waste is diminishing existing portions. The great rivers annually carry down vast quantities of vegetable and animal remains, which are entombed in the sedimentary beds formed by the earthy particles deposited from their turbid waters.

Igneous rocks are still being formed by volcanic eruption, and existing rocks rent and displaced by earthquakes; but the sum of effects produced by all these agencies within the historic period, when compared with that of the greater intervals of geological time, is so trifling in amount as to make the known history of the world appear as a mere point in time compared to the stupendous duration of the geological periods.

ISOTHERMAL, ISOTHERAL, AND ISOCHIMENAL LINES.

In chapter V., page 53, the Isothermal lines are fully described, to which the learner can refer. We have now to explain what is meant by *Isotheral* and *Isochimenal* lines. Isothermal lines indicate the mean annual temperature of the places which they pass through; but as two places on the same isotherm may differ very much in their temperatures during the summer and winter months, it is necessary, in order to have a more correct idea of their climates, to know their mean summer and their mean winter temperatures also. For example, the mean annual temperatures of London and New York are nearly the same, namely 51°; but their mean summer and mean winter temperatures are very different. In London, the mean summer temperature is about 63°, and the mean winter, about 39½°; while in New York, the former is about 71°, and the latter about 30°. In London, therefore, the climate is much more equable than in New York.

Hence it has been proposed to show upon maps the mean summer, and the mean winter temperature of places, as well as their mean annual temperatures; and in the same way, namely, by means of connecting lines. Such lines are called *Isotheral*[a] when they are drawn through places whose mean summer temperatures are equal; and *Isochimenal*[a] when drawn through places whose mean winter temperatures are equal.

Generally speaking, the difference between the mean summer and mean winter temperatures of places increase as the distance from the equator. In the torrid zone the temperature varies very little throughout the year; and the summer may be said to be perpetual. In some places near the equator, the difference between the temperature of the wamest month, and the coldest—if coldest it can be called—does not amount to more than two or three degrees. In Singapore, for example, the difference is only about 2°; at Trincomalee, 6°; and at Madras, 9°. But in the frigid zones, and in those parts of the temperate zones which lie near them, the difference between the mean summer and mean winter temperatures is very striking In Melville island, for example, the difference is 65°; at Quebec, 54°; and at St. Petersburgh, 43°.

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[a] *Isotheral* is from two Greek words which signify equal *summer*; and *Isochimenal* implies equal *winter*.

In illustration of the subject, we shall add in tabular form, the mean summer, winter, and annual temperatures of a few places of note in different parts of the world.

Name of Place.	Latitude.	Mean Summer Temperature.	Mean Winter Temperature.	Annual Temperature.
	° ʹ	°	°	°
London, . . .	N. 51 30	63	39½	51
Dublin, . . .	,, 53 23	60	40	50
Edinburgh, . . .	,, 55 57	58	38	47
Paris, ...	,, 48 50	64	38	51
Vienna, . . .	,, 48 12	69	32	51
Berlin, . . .	,, 52 31	64	31	48
Copenhagen, . .	,, 55 41	62	31	46
Stockholm, . . .	,, 59 21	60	26	43
St. Petersburgh, . .	,, 59 56	61	18	39
Moscow, . . .	,, 55 45	64	15	40
Naples, . . .	,, 40 52	75	48	62
Rome, . . .	,, 41 54	74	47	61
Madrid, . . .	,, 40 25	76	43	59
Constantinople, . .	,, 41 0	71	41	56
Jerusalem, . . .	,, 31 47	74	50	62
Calcutta, . . .	,, 22 33	86	72	82
Bombay, . . .	,, 18 56	83	77	81
Pekin, ...	,, 39 54	75	28	53
Canton, . . .	,, 23 8	82	54	69
Hobart Town, . .	S. 42 53	63	42	52
Auckland, . . .	,, 36 51	67	51	59
Cairo, ...	N. 30 2	85	58	72
Cape of Good Hope, .	S. 34 11	74	58	66
New York, . . .	N. 40 49	71	30	51
New Orleans, . .	,, 40 42	82	55	69
Rio Janeiro, . .	S. 22 54	79	68	73
Quebec, . . .	N. 46 49	68	14	41
Toronto, . . .	,, 43 40	65	25	45

CELTIC AND ANGLO SAXON ROOTS,

PRINCIPALLY THOSE FROM WHICH THE NAMES OF PLACES IN GREAT BRITAIN AND IRELAND ARE DERIVED.

[In the author's *Dictionary of Derivations*, under the head of "Geographical Etymologies," these ROOTS, and the names of the places derived from them, are fully explained.]

CELTIC ROOTS.

Aber, the mouth of a river.
Agh, a field.
Alp, high.
Ard, high; a height, a promontory.
Ath, a ford.
Auchter, the summit or top of the height.
Augh, a corruption of *Ath*.
Avon, water, a river.
Baan, white.
Bal, Ball, Bally, a townland, a township, a village, a town.
Beg, small or little.
Bel, the mouth of the ford, or the entrance of a river.
Ben, Pen, a mountain, a promontory, or headland.
Blair, a plain cleared of woods.
Borris, Burris, the Irish form of *burgess* or *borough*.
Boy, yellow.
Brough, a fort or enclosure of earth, like Lis and Rath. (The old Irish form was *brugh*, which is evidently from *Burgh*, by metathesis.)
Bun, the mouth or end of a river.
Car, Caer, Cahir, a fort.
Cairn, Carn, a conical heap of stones, generally monumental; also, a mountain, properly one with a cairn on the top.
Cam, crooked, bending.
Clar, a board, a table, a level.
Clon, a lawn, a meadow, a plain.
Clough, Clogh, a stone, a stone house, a strong or fortified house.
Craig, Carrick, a rock, a rocky place, a craggy or rocky hill.
Croom, Crum, crooked or bending.
Cul, the back or hinder part, a recess, an angle or corner.
Derry, Dare, the oak, an oak wood.
Dhu, black.
Drum, a ridge, a back, a hill.
Dun, a fort, a fort on a hill, a hill, a fortified residence, a place of abode, a town.
Fer, a man.
Fin, white, fair.
Gall, a stranger or foreigner.
Inis, Innis, Ennis, Inch, an island, a place nearly or occasionally surrounded by water.
Inver, the mouth of a river.
Ken, Kin, the head, a headland or cape.
Kill, a cell, a cloister, a church, a church-yard, or burying-place. Kill also means (*coille*) a wood, in many of the names in which it occurs.
Knoc, a hill.

Lin, Lyn, a deep pool, particularly one formed below a waterfall.
Magh, a plain.
Money, a shrubbery, a brake.
Mor, More, great.
Moy, another form of *Magh*, a plain.
Mull, a bald or bare head, a bare headland.
Mullen, a mill.
Rath, an earthen fort or mound.
Ros, Ross, a promontory or peninsula.
Sleive, a mountain.
Strath, a long and broad valley, through which a river generally flows.
Tra, a strand.

ANGLO-SAXON ROOTS.

Ac, Ack, Auck, Ax, an *oak*.
Athel, noble.
Berg, Burg, Burgh, Borough, Bury. The Greek *purgos* (a tower, a castle, a fortified city, a town) seems to be the root of all these words. Compare the Celtic word Dun.
Botl, Botle, an abode or dwelling-place.
Burne, a stream, a brook, a *bourn*.
By, Bye, a dwelling or habitation, a village or town.
Carr, a rock, a scar; (rocky or craggy islets).
Ceap, cattle, saleable commodities, sale, bargaining, traffic.
Comb, a hollow or low place between hills, a valley. The Welsh form is *Cwm*.
Cot, Cote, a cot or cottage.
Dale, from the Danish dal, or the German thal, a vale or valley. *Dell* is another form of dale.
Den, a deep valley, a valley in a plain.
Ea, Ey, water, an island.
Ham, a home or dwelling, a village, a town.
Hurst, a wood, a forest.
Ing, Inge, a field or meadow, a pasture.
Law, a conical hill, a mount, a tract of ground gently rising.
Mere, a sea, a lake, a pool, a marsh.
Minster, a monastery.
Ness, a promontory.
Nord, the north.
Nether, downward, lower.
Scrobs, a shrub or bush.
Shire, a division, a share, a shire, or county.
Stan, a stone.
Stede, a stead, a station, a place.
Stock, Stoke, Stow, a place, a dwelling.
Strat, a street, a way, or road.
Sud, Suth, south.
Thorp, a village.
Wald, Weald, a wood or forest, a wold or wild.
Wick, Wich, a town; also, a bay or bend in a river, a harbour.
Worth, a farm, a village, a town.

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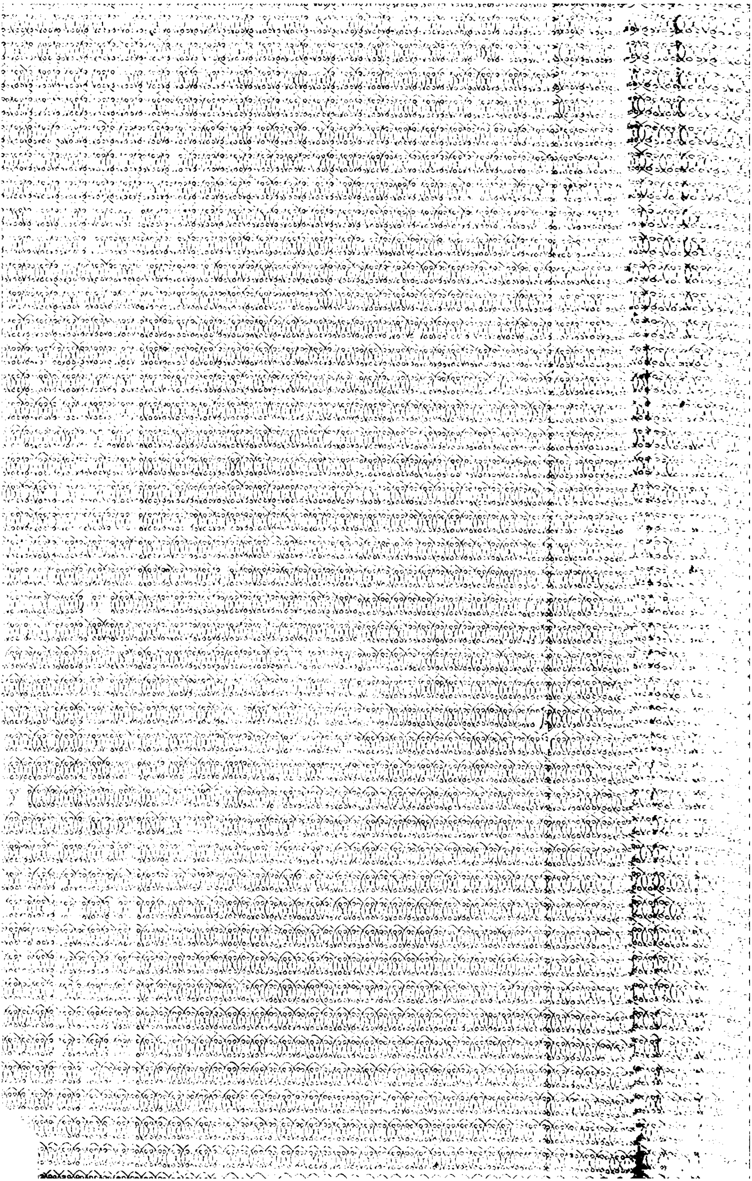

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